Telindus 1431 SHDSL CPE

Telindus 1431 SHDSL CPE

User and reference manual

Version: 2.1 - 201604

Telindus Technical Publications – Geldenaaksebaan 335 - B-3001 Leuven - Belgium – Tel. +32 16 382011

Document properties

Subject	Telindus 1431 SHDSL CPE
Manual type	User and reference manual
Version	2.1
Code	201604
Modification date	20 December 2005 ©Telindus

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Safety requirements

Carefully read the safety instructions, installation precautions and connection precautions as stated in chapter 2 - Installing and connecting the Telindus 1431 SHDSL CPE on page 11.

Statements

CE

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Hereby, Telindus declares that this Telindus 1431 SHDSL CPE complies with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Hierbij verklaart Telindus dat deze Telindus 1431 SHDSL CPE overeenstemt met de essentiële vereisten en andere relevante bepalingen van Richtlijn 1999/5/EC.

Par la présente, Telindus déclare que ce Telindus 1431 SHDSL CPE est en conformité avec les exigences essentielles et autres articles applicables de la Directive 1999/5/EC.

Hiermit, Telindus erklärt daß dieser Telindus 1431 SHDSL CPE in Fügsamkeit ist mit den wesentlichen Anforderungen und anderen relevanten Bereitstellungen von Direktive 1999/5/EC.

Mediante la presente, Telindus declara que el Telindus 1431 SHDSL CPE cumple con los requisitos esenciales y las demás prescripciones relevantes de la Directiva 1999/5/CE.

A Telindus declara que o Telindus 1431 SHDSL CPE cumpre os principais requisitos e outras disposições da Directiva 1999/5/EC.

Col presente, Telindus dichiara che questo Telindus 1431 SHDSL CPE è in acquiescenza coi requisiti essenziali e stipulazioni attinenti ed altre di Direttivo 1999/5/EC.

Με το παρόν η Telindus δηλώνει ότι το Telindus 1431 SHDSL CPE είναι συμμορφούμενο με τις βασικές απαιτήσεις και με τις υπόλοιπες σχετικές διατάξεις της οδηγίας 1999/5/EC.

Environmental information

The crossed-out wheeled bin means that within the European Union the product must be taken to separate collection at the product end of life. This applies to the device but also to any accessories marked with this symbol. Do not dispose of these products as unsorted municipal waste.
If you need more information on the collection, reuse and recycling systems, please contact your local waste administration. You can also contact us for more information on the environmental specifications of our products.

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Wenn Sie mehr Informationen brauchen über die Sammlung und Recycling Systemen, bitte konsultieren Sie Ihre örtliche Abfälle Verwaltung. Für mehr Informationen über die Umweltaspekten unserer Produkte, wenden Sie sich an unserer Kundendienst.

Documentation set

The documentation set of the Telindus 1431 SHDSL CPE currently consists of the following:

Document	Description
Telindus 1431 SHDSL CPE manual (this manual)	This is the manual you are reading now. It shows you how to install and connect the Telindus 1431 SHDSL CPE and gives you a basic configuration. It also contains a complete description of all the configuration, status, performance and alarm parameters for look-up purposes.
maintenance and management application manuals	The Telindus 1431 SHDSL CPE can be maintained and managed by a variety of maintenance and management tools. Refer to 1.4 - Maintenance and management tools on page 8 for an introduction on these tools and for a reference to the manual of these tools.
cable documents	A wide variety of cables exist to connect the Telindus 1431 SHDSL CPE. The Data cables document (PDF) and the Management cables document (PDF) describe these cables.

All these documents, together with the free maintenance tool TMA and the firmware of the Telindus devices, can be found on the Telindus Access Products distribution CD that is delivered with all Telindus products.

Organisation of this manual

This manual contains the following main parts:

Part	This part …
User manual	shows you how to install and connect the Telindus 1431 SHDSL CPE. It also gives a basic configuration of the Telindus 1431 SHDSL CPE.
Reference manual	gives more detailed information on the Telindus 1431 SHDSL CPE, such as software download procedures, technical specifications, etc. It also contains a complete description of all the configuration, status, performance and alarm parameters for look-up purposes.
Annex	gives additional information, such as product sales codes.

Refer to the Table of contents on page x for a detailed overview of this manual.

Typographical conventions

The following typographical conventions are used in this manual:

The format …	indicates …
Normal	normal text.
Italic	• new or emphasised words • application windows, buttons and fields. E.g. In the *Filename* field enter …
`Computer`	text you have to enter at the DOS or CLI prompt, computer output and code examples. E.g. `NOK,1,1,Invalid command.`

`Computer Bold`	text you have to enter at the DOS or CLI prompt when it is part of a mix of computer input and output.
	E.g.
	`/o1003:"Edit Configuration"`
	`>`**`get sysName`**
	`  sysName = "Orchid 1003 LAN"`
	`/o1003:"Edit Configuration"`
	`>`

Narrow	containment tree objects and attributes of a device when they are mentioned in the normal text. I.e. when they are not a part of computer input or output. E.g. Use the sysName attribute in order to …
<Narrow>	containment tree objects or attributes or part of them that are variable. I.e. depending on the product version, used interface, etc. the names of these objects or attributes are slightly different. E.g. topObject/<modularIf>/someAttribute means that the name of the object <modularIf> depends on which modular interface you use. For example, v35 in case of a V.35 interface, g703 in case of a G.703 interface, etc.
Blue	references to other parts in the manual. E.g. “Refer to xx - Title for more information”.
Blue underline	• a hyperlink to a web site. E.g. www.telindus.com • a reference to another manual. E.g. “Refer to the TMA manual (PDF) for more information”. The abbreviation between brackets is an indication of the file format (PDF = Portable Document Format / CHM = Compiled HTML Help).

Graphical conventions

The following icons are used in this manual:

Icon	Name	This icon indicates …
	Remark	remarks or useful tips.
	Caution	text to be read carefully in order to avoid damage to the device.
	Warning	text to be read carefully in order to avoid injury.
	DIP switch	a DIP switch or strap table.
	Basic attribute	a basic attribute in the containment tree of the Telindus 1431 SHDSL CPE.
	Advanced attribute	an advanced attribute in the containment tree of the Telindus 1431 SHDSL CPE.
	Structured attribute	a structured attribute within another attribute in the containment tree of the Telindus 1431 SHDSL CPE.
	Action	an action in the containment tree of the Telindus 1431 SHDSL CPE.

Reading a DIP switch table

At several places in this manual DIP switch tables are shown. To enable you to read such a table in a correct manner it is explained below.

A DIP switch table has the following layout:

DIP switch name	DS1 no.	Setting	Funtion
	1	**on**	
		off	

1 2 3 4 5

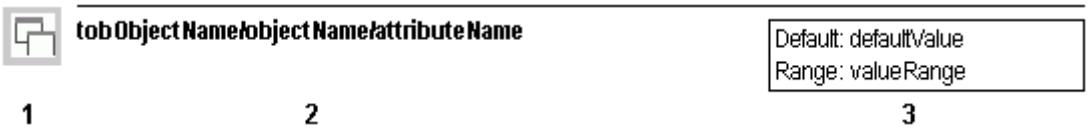
The following table explains the DIP switch configuration table layout:

Number	This position displays ...
1	the DIP switch icon.
2	the DIP switch name.
3	the DIP switch position on the DIP switch bank. The abbreviations mean the following: DS1 no. 1: DIP switch bank number 1, switch position number 1
4	the possible settings of the DIP switch: on and off. The default setting is printed in bold.
5	the function associated with the corresponding DIP switch setting.

Reading an attribute string

At several places in this manual attribute strings are shown. To enable you to read such a string in a correct manner it is explained below.

An attribute string has the following layout:



1 2 3

The following table explains the attribute string layout:

Number	This position displays ...
1	the attribute icon. It indicates that the string which follows is an attribute string. Refer to Graphical conventions on page vii for more information.
2	the attribute name and its position in the containment tree.
3	the default value of a configuration attribute.

TDRE version

The Telindus Dynamic Routing Engine (TDRE) is a feature-rich operating system that guarantees a common feature set across the different Telindus product lines and a uniform support by maintenance and management tools.

This manual describes the features, containment tree and attributes of the TDRE version 11.5.

Audience

This manual is intended for computer-literate people, who have a working knowledge of computing and networking principles.

Your feedback

Your satisfaction about this purchase is an extremely important priority to all of us at Telindus. Accordingly, all electronic, functional and cosmetic aspects of this new unit have been carefully and thoroughly tested and inspected. If any fault is found with this unit or should you have any other quality-related comment concerning this delivery, please submit the Quality Comment Form on our web page at www.telindusproducts.com/quality.

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User manual

1 Introducing the Telindus 1431 SHDSL CPE

This chapter gives an introduction to the Telindus 1431 SHDSL CPE. The following gives an overview of this chapter:

- 1.1 - What is the Telindus 1431 SHDSL CPE? on page 4
- 1.2 - Telindus 1431 SHDSL CPE applications on page 5
- 1.3 - Modular user interface overview on page 7
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- 1.5 - Maintenance and management tools connection possibilities on page 10

1.1 What is the Telindus 1431 SHDSL CPE?

The Telindus 1431 SHDSL CPE uses state-of-the-art SHDSL modulation to deliver leased line, Frame Relay and ATM services over an ATM based DSLAM access network.

For this purpose the unit can accept an exchangeable serial or G.703 interface. The equipment additionally features a fixed Ethernet auto-sense 10/100 Base-T connection for the delivery of professional IP services.

The Telindus 1431 SHDSL CPE uses symmetrical full-duplex transmission up to 2.3 or 4.6 Mbps over a single or dual two-wire unconditioned unshielded twisted-pair cable. The line speed can be adapted to optimise the throughput as a function of the characteristics of the local loop. The equipment is based on the ITU-T G.991.2 SHDSL recommendation, which guarantees spectral compatibility with legacy and ADSL transmission systems in the same cable bundle.

The Frame Relay service is encapsulated in ATM using the Frame Relay forum recommendations FRF 5 or FRF 8. The leased line service is emulated using the ATM Circuit Emulation Service (CES). The ATM Service delivery on E1 (G.703) is accomplished according to the ITU-T standard I 432.3. As a result, the equipment enables service providers to deliver professional Frame-Relay, Clear channel, and ATM services based on a standard ATM DSLAM based network.

Fully supported by the TDRE (Telindus Dynamic Routing Engine), the unit supports also differentiated IP services including VPNs (Virtual Private Networks) and the delivery of application dependent QoS (Quality of Service) connections.

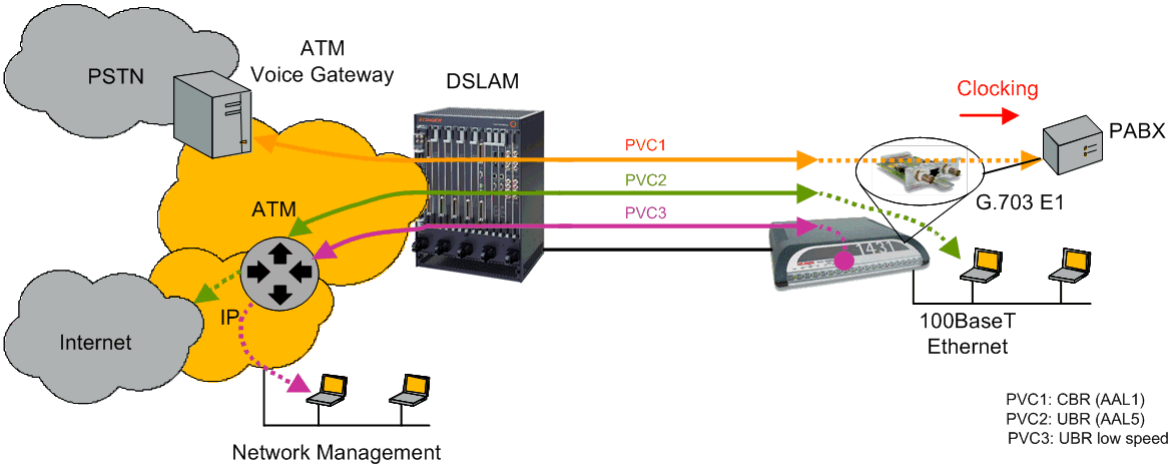
In addition to connections to DSLAMs, the Telindus 1431 SHDSL CPE can also be used in a point-to-point configuration. In this case, the CES functionality, combined with the built-in router allow the simultaneous transport of clear channel and Ethernet based services.

The equipment supports different management interfaces on different levels of the network. At the local level it is possible to manage the equipment over a management console interface by means of a PC maintenance tool, a command line interface or a menu driven interface. On IP level the equipment supports Telnet, SNMP, HTTP or TFTP/FTP. In this way it is possible to integrate the unit in any existing network management environment. At the network level it is possible to manage the access network with a stand-alone element manager or with an element manager integrated into HP OpenView.

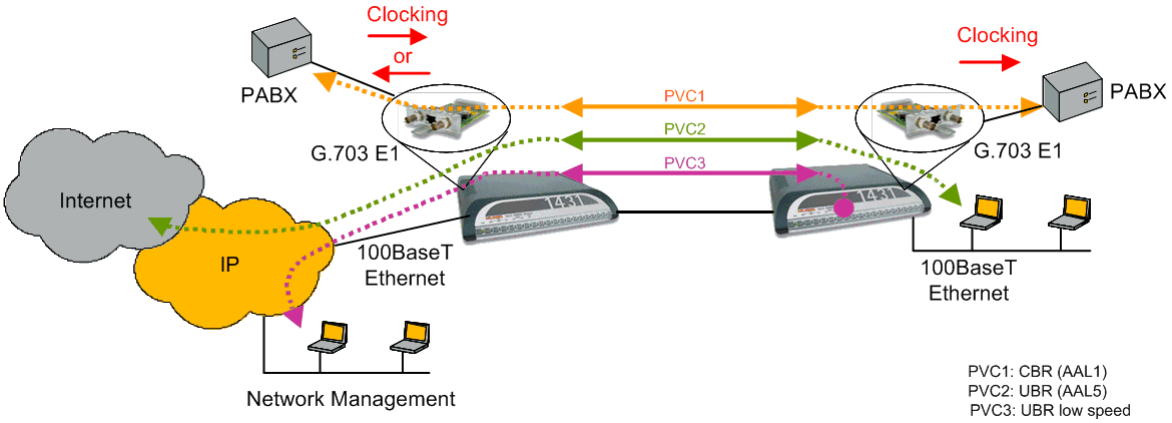
1.2 Telindus 1431 SHDSL CPE applications

Below some examples of Telindus Router applications are shown.

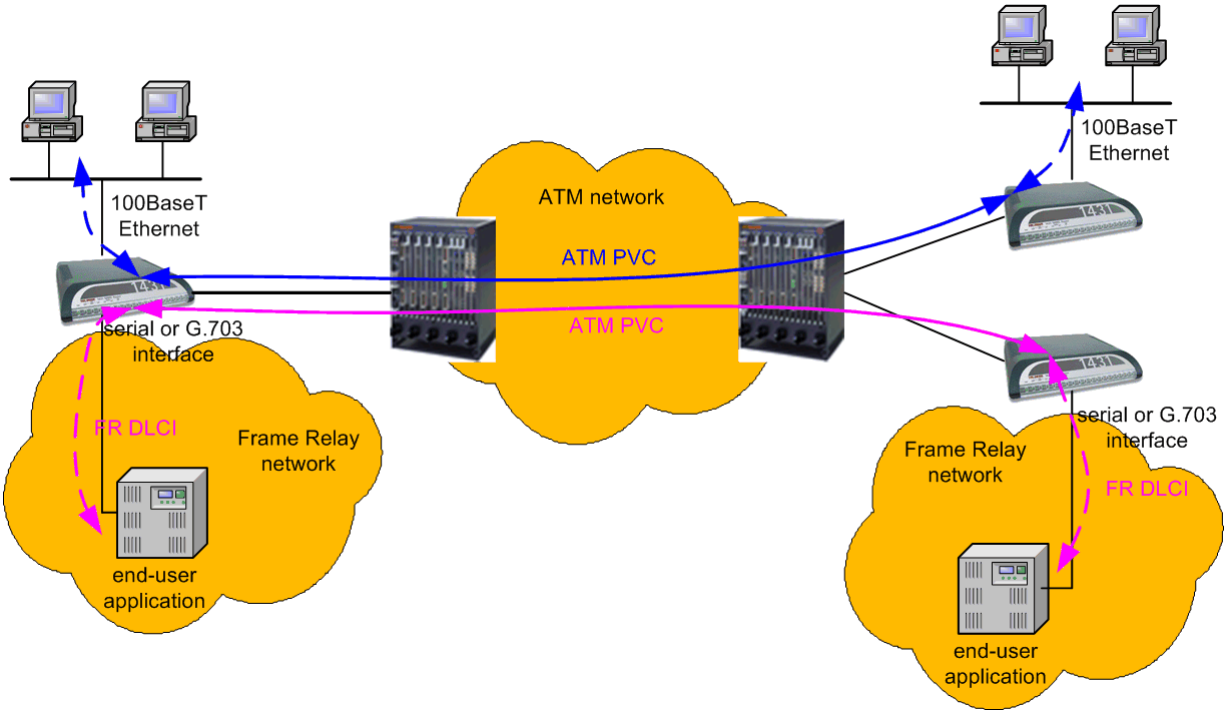
Combined IP and Leased Line service on an ATM broadband network



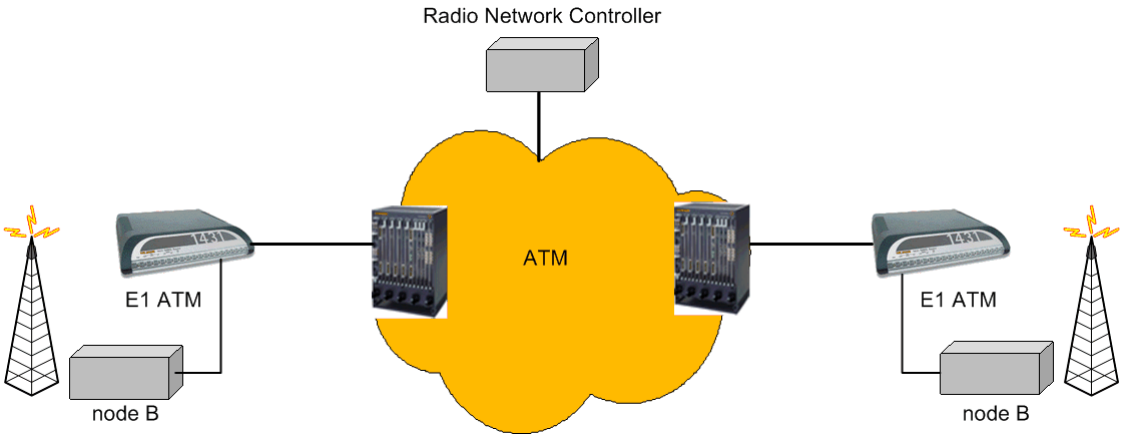
Combined IP and Leased Line service in a point-to-point set-up



Combined IP and Frame Relay service on an ATM broadband network



UMTS base-station connectivity based on ATM E1 connections



1.3 Modular user interface overview

The Telindus 1431 SHDSL CPE is designed to deliver leased line and Frame Relay services over an ATM based DSLAM access network. For this purpose the unit accepts exchangeable serial and G.703 interfaces.

The following modular user interfaces are supported:

Modular user interface	Supported user and line speeds
V35	V.35 is only specified up to 2 Mbps. V35 interfaces with PCB revision …· • 0.2 or lower only support speeds up to 2 Mbps. • 0.3 or higher support all user and corresponding line speeds, provided short cables are used.
V36	All user and corresponding line speeds are supported.
RS530	All user and corresponding line speeds are supported.
X21	All user and corresponding line speeds are supported.
G703	• Unframed mode: fixed 2 Mbps user and line speed. • Framed mode: fixed 2 Mbps user speed (time slots have to be configured instead of a user speed). All line speeds between 64 kbps and 2 Mbps are supported.

1.4 Maintenance and management tools

The Telindus 1431 SHDSL CPE is manageable in many different ways. This section gives a quick overview of the various maintenance and management tools.

Maintenance or management tool	Description and reference
TMA	TMA (Telindus Maintenance Application) is a free Windows software package with a comprehensive graphical user interface that enables you to control the Telindus products completely. I.e. to access their configuration attributes and look at status, performance and alarm information. Refer to 4 - Maintaining the Telindus 1431 SHDSL CPE on page 35 and the TMA manual (PDF) for more information.
TMA Element Management	TMA Element Management is a management application designed to monitor large numbers of Telindus devices. It combines the easy to use graphical interface of the stand-alone version of TMA with an event-logging application called the Element Viewer. Refer to the TMA Element Management manual (PDF/CHM) for more information.
TMA for HP OpenView	TMA for HP OpenView is the management application that runs on the widely spread network management platform HP OpenView. It combines the easy to use graphical interface of the stand-alone version of TMA with the advantages and features of HP OpenView. Refer to the TMA for HP OpenView manual (PDF) for more information.
TMA CLI	TMA CLI (TMA Command Line Interface) enables you to use its commands in scripts in order to automate management actions. This is particularly useful in large networks. TMA CLI is a complementary product to TMA, TMA Element Management and TMA for HP OpenView. Refer to the TMA CLI manual (PDF) for more information.
ATWIN	ATWIN is a menu-driven user interface. You can read and change all attributes as with TMA, but in a more basic, textual representation using a VT100 terminal. Refer to the Maintenance tools manual (PDF) for more information.
CLI	CLI is also a Command Line Interface, although not so extensive as TMA CLI. Experienced users who are familiar with the syntax can access the Telindus devices more quickly than with TMA or ATWIN. Refer to the Maintenance tools manual (PDF) for more information.
Web Interface	The Web Interface is an ATWIN alike menu-driven user interface. You can read and change all attributes as with TMA, but in a more basic representation using a web browser. Refer to the Maintenance tools manual (PDF) for more information. Note that the HTTP interfaces are not only available on port 80, but also on port 8080. This allows connecting to the HTTP interfaces in case a NAT service is defined on port 80.

Maintenance or management tool	Description and reference
SNMP	You can manage the Telindus 1431 SHDSL CPE through SNMP using any SNMP browser. The Telindus 1431 SHDSL CPE supports MIB2 and a private MIB, including traps. The private MIB comes with your copy of TMA. After installation of the TMA data files, the private MIB file is available in directory *C:\Program Files\TMA\snmp*[1] with the name *<filename>.mib*[2]. Refer to 14.11 - SNMP configuration attributes on page 553 and the documentation of your SNMP browser for more information.
Easy Configurator	The Easy Configurator allows you to add HTML pages on top of the standard Web Interface by adding a set of specific files on the file system of the Telindus 1431 SHDSL CPE. These files can be made either by Telindus or by the customer itself. The goal is to offer a simple, custom made web interface which allows only to change or show those parameters that are relevant for a certain application or customer. Refer to the Maintenance tools manual (PDF) for more information. Note that the HTTP interfaces are not only available on port 80, but also on port 8080. This allows connecting to the HTTP interfaces in case a NAT service is defined on port 80.

1. The first part of the directory path may be different if you did not choose the default path during the installation of the TMA data files.
2. The filename is product dependent. To determine which MIB file corresponds with which product, refer to the *models.nms* file (located in *C:\Program Files\TMA\model*[1]).

1.5 Maintenance and management tools connection possibilities

The following table gives an overview of all the maintenance and management tools and how you can connect them with the Telindus 1431 SHDSL CPE:

Maintenance or management tool	Tool - Telindus 1431 SHDSL CPE connection		Tool - management concentrator connection[1]	
	Serial[2]	IP[3]	Serial[2]	IP[3]
CLI	X[4]	X[5]	X[4]	X[5]
ATWIN	X[4]	X[5]	X[4]	X[5]
TMA	X	X	X	X
TMA CLI	X	X	X	X
TMA Element Management		X		X
TMA for HP OpenView		X		X
SNMP[6]		X		X
Web Interface[7]		X		X

1. Examples of management concentrators are the Orchid 1003 LAN, the Telindus 1030 Router series, the Telindus 2300 SHDSL series, etc. Refer to their corresponding manuals for more information on how to set these devices up as management proxy.
2. A serial connection is a connection between the COM port of your PC and the control connector of the Telindus 1431 SHDSL CPE using a male-female DB9 cable.
3. An IP connection is a connection between your PC and the Telindus 1431 SHDSL CPE over an IP network.
4. Using a VT100 terminal (emulation program).
5. Using Telnet.
6. Using an SNMP browser.
7. Using a web browser.

2 Installing and connecting the Telindus 1431 SHDSL CPE

First this chapter gives some important safety instructions. Then it explains how to install and connect the Telindus 1431 SHDSL CPE.

You are advised to read this chapter from the beginning to the end, without skipping any part. By doing so, your Telindus 1431 SHDSL CPE will be completely installed and ready for configuration when you reach the end of this chapter.

The following gives an overview of this chapter:

- 2.1 - Safety instructions on page 12
- 2.2 - Unpacking on page 13
- 2.3 - Selecting a site on page 14
- 2.4 - Mounting the Telindus 1431 SHDSL CPE to a wall on page 15
- 2.5 - Connection precautions on page 17
- 2.6 - Connecting the Telindus 1431 SHDSL CPE on page 18
- 2.7 - The front panel LED indicators on page 24

2.1 Safety instructions

IMPORTANT SAFETY INSTRUCTIONS

Disconnect the power supply before installing, adjusting or servicing the unit.

WICHTIGE SICHERHEITSINSTRUKTIONEN

Vor sämtlichen Arbeiten am Gerät (Installation, Einstellungen, Reparaturen etc.) sollten Sie den Netzstecker aus der Steckdose ziehen.

SAFETY WARNING

To avoid damage to the unit, please observe all procedures described in this chapter.

SICHERHEITSBESTIMMUNGEN

Um eine Beschädigung des Gerätes zu verhindern, beachten Sie bitte unbedingt die Sicherheitsbestimmungen die in diesem Abschnitt beschrieben werden.

Ensure that the unit and its connected equipment all use the same power and ground, to reduce noise interference and possible safety hazards caused by differences in ground or earth potentials.

2.2 Unpacking

Checking the shipping carton

Rough handling during shipping causes most early failures. Before installation, check the shipping carton for signs of damage:

- If the shipping carton is damaged, please place a claim with the carrier company immediately.
- If the shipping carton is undamaged, do not dispose of it in case you need to store the unit or ship it in the future.

Package contents

The box should contain the following items:

- Telindus 1431 SHDSL CPE
- 48 Vdc power supply plug
- TMA CD-ROM (including this User and Reference manual in PDF format)

Optionally (depending which sales item you ordered):

- external power supply with power cord

2.3 Selecting a site

WARNING

Always place the unit on its feet without blocking the air vents.

Do not stack multiple units directly onto each other, as stacking can cause heat build-up that could damage the equipment.

ACHTUNG

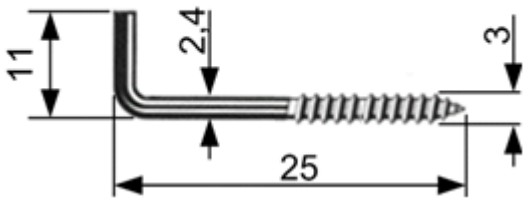
Stellen Sie das Gerät niemals seitlich, sondern nur auf den Füßen auf und achten Sie darauf, daß die Lüftungsschlitze an der Seitenverkleidung frei bleiben.

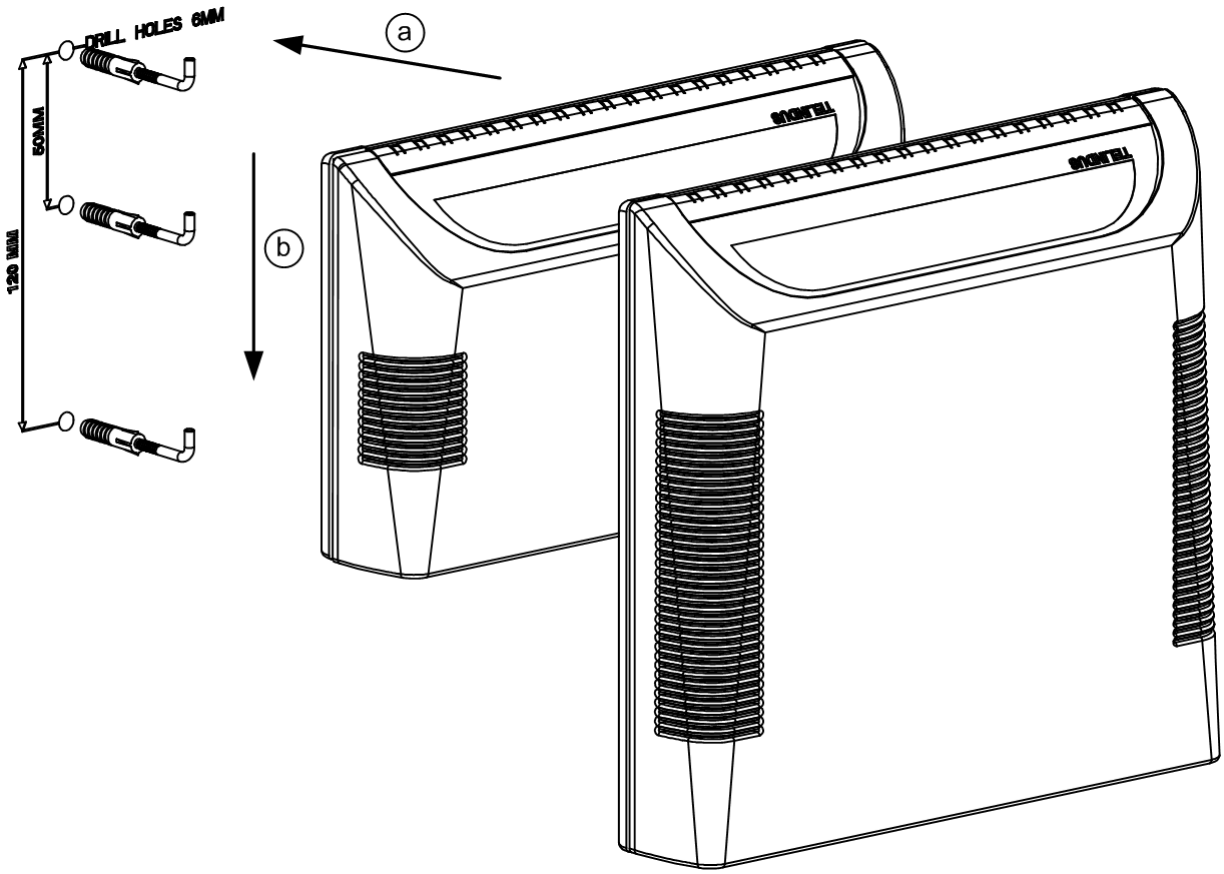
Stapeln Sie nicht mehrere Geräte direkt übereinander, dies kann zu einem Hitzestau führen.

Install the unit in an area free of extreme temperatures, humidity, shock and vibration. Position it so that you can easily see and access the front panel and its control indicators. Leave enough clearance at the back for cables and wires. Position the unit within the correct distances for the different accesses and within 2m of a power outlet.

2.4 Mounting the Telindus 1431 SHDSL CPE to a wall

The Telindus 1431 SHDSL CPE can be mounted to the wall. In order to do so, proceed as follows:

Step	Action
1	Drill two holes in the wall, according to the following specifications: • hole diameter: 4 mm • distance between the holes: - in case of the PBOX05 housing: 120 mm - in case of the PBOX06 housing: 60 mm • hole depth: at least 25 mm
2	Insert two wall plugs in the holes. The plugs should have the following dimensions: • diameter: 4 mm • length: 20 mm
3	Screw two square hooks (steel zinc plated and white epox) in the plugs. The square hooks should have the following dimensions: 
4	Slide the Telindus 1431 SHDSL CPE over the hooks until it touches the wall, as shown in the figure below.
5	Slide the Telindus 1431 SHDSL CPE down until it is firmly attached, as shown in the figure below.


DRILL HOLES 6MM
50MM
120 MM
a
b

2.5 Connection precautions

ESD WARNING

The circuit boards are sensitive to electrostatic discharges (ESD) and should be handled with care. It is advisable to ensure an optimal electrical contact between yourself, the working area and a safety ground before touching any circuit board. Take special care not to touch any component or connector on the circuit board.

EMC WARNING

The Telindus access products are fully EMC compliant. To ensure compliance with EMC directive 89/336/EEC, shielded cables or ferrite beads have to be used.

NOTE

This unit may be powered by an IT power system.

The connectors of the Telindus 1431 SHDSL CPE should only be connected to the following circuit types:

Connector name	Connector label	Connector type	Circuit type
LAN connector	LAN	RJ45	SELV
modular user interface connector	(none)	(depends on the type of interface)	SELV
SHDSL line connector	LINE	RJ12	TNV-1
control connector	CTRL	subD-9	SELV

- SELV (Safety Extra Low Voltage): local connection (e.g. PC to Telindus 1431 SHDSL CPE) or leased line inside the building.
- TNV-1 (Telecom Network Voltage): leased line outside the building.
- TNV-2: PSTN from PABX inside the building.
- TNV-3: PSTN from operator PABX outside the building.

2.6 Connecting the Telindus 1431 SHDSL CPE

This section explains how to connect the Telindus 1431 SHDSL CPE. The following gives an overview of this section:

- 2.6.1 - Rear view of the Telindus 1431 SHDSL CPE on page 19
- 2.6.2 - The different parts of the Telindus 1431 SHDSL CPE on page 20
- 2.6.3 - Connecting the Telindus 1431 SHDSL CPE - an example on page 22

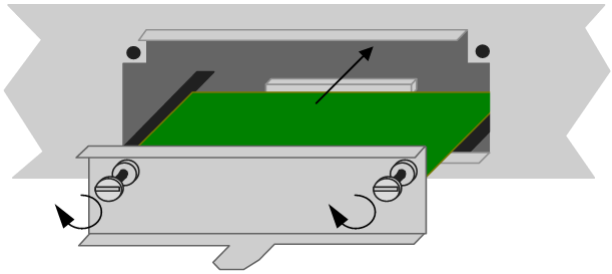
2.6.1 Rear view of the Telindus 1431 SHDSL CPE

The following figure shows the back panel of the Telindus 1431 SHDSL CPE:

2.6.2 The different parts of the Telindus 1431 SHDSL CPE

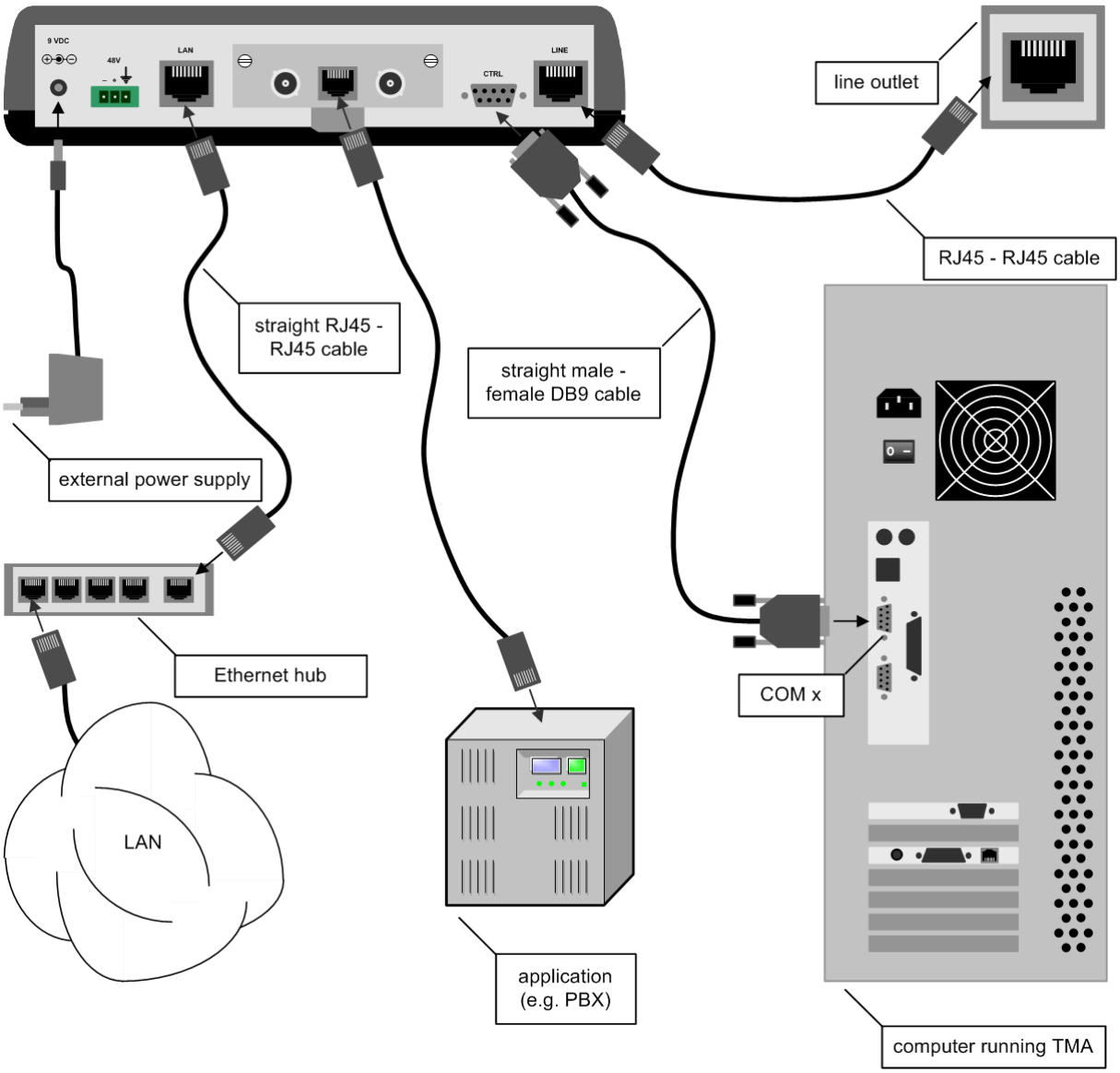
The following table gives an overview of the parts located at the back of the Telindus 1431 SHDSL CPE and reveals their function:

Label	Function
9 VDC	This is the 9 Vdc power input. Insert the plug of the 9 Vdc external power supply in this socket. **Important remark** Either use the 9 Vdc or use the 48 Vdc power input. Do not use them both at the same time. Refer to 21.22 - Power requirements on page 830 for the power specifications of the Telindus 1431 SHDSL CPE.
48V	This is the 48 Vdc power input. First wire the 48 Vdc power supply plug (delivered with the Telindus 1431 SHDSL CPE). Then insert the plug in the 48 Vdc socket. The + and - indications are with respect to each other, not to ground level. This means that for a standard -48 Vdc connection, the ground has to be connected to +, while the negative voltage has to be connected to the -. The 48 Vdc power supply plug also has an earth connection. **Important remark** Either use the 9 Vdc or use the 48 Vdc power input. Do not use them both at the same time. Refer to 21.22 - Power requirements on page 830 for the power specifications of the Telindus 1431 SHDSL CPE.
LAN	This RJ45 connector is the connection towards the LAN. Connect one side of an RJ45 to RJ45 cable (not included) to the LAN connector of the Telindus 1431 SHDSL CPE and the other side to a network outlet. If you want to connect the Telindus 1431 SHDSL CPE to … • a regular Ethernet network outlet, then use a crossed RJ45 cable. • an Ethernet hub, then use a straight RJ45 cable. Refer to 21.4 - LAN interface specifications on page 816 for the specifications of this connector.

Label	Function
- (empty interface slot)	This empty slot is provided to insert the desired modular user interface without opening the housing. To insert the modular user interface, proceed as follows: 1. Gently slide the modular user interface on the two inner slides into the empty slot. 2. When nearly inserted, press tight. 3. Fasten both screws. 4. When the modular user interface has been inserted, connect the connector to the application. 
CTRL	This female 9-pins subD connector is the control connector. You can connect this connector to a COM port of your PC with a straight male-female DB9 cable (not included). This enables you to manage the Telindus 1431 SHDSL CPE locally, using TMA, CLI, ATWIN etc. You can also connect this connector to a management concentrator, also for management purposes. Refer to 21.5 - Control connector specifications on page 817 for the specifications of this connector.
LINE	This RJ45 connector is the connection towards the SHDSL line. Connect one side of an RJ45 to RJ45 cable (not included) to the LINE connector of the Telindus 1431 SHDSL CPE and the other side to an SHDSL outlet. For optimum performance, the used line pairs have to be properly twisted pairs. Refer to 21.1 - SHDSL line specifications on page 812 for the specifications of this connector.

2.6.3 Connecting the Telindus 1431 SHDSL CPE - an example

The following figure shows a typical Telindus 1431 SHDSL CPE set-up:



In this set-up …

- the LINE connector is connected to an SHDSL line outlet using an RJ45 - RJ45 cable. In this way the Telindus 1431 SHDSL CPE is connected to the WAN. You can, for example, connect the Telindus 1431 SHDSL CPE to a remote network over a leased line. Refer to 1.2 - Telindus 1431 SHDSL CPE applications on page 5 for some typical applications.
- the CTRL connector is connected to the COM port of a computer using a straight male - female DB9 cable. In this way you can, for example, manage the Telindus 1431 SHDSL CPE locally using TMA (CLI), CLI, ATWIN, etc.
- the LAN connector is connected to an Ethernet hub using a straight RJ45 - RJ45 cable. In this way the Telindus 1431 SHDSL CPE is connected to your local network (LAN).
- a modular user interface is inserted in the interface slot. You can then connect the connector of the modular user interface to your application.
- the external power supply is connected to the 9V power input.

For optimum performance, the used line pairs have to be properly twisted pairs.

2.7 The front panel LED indicators

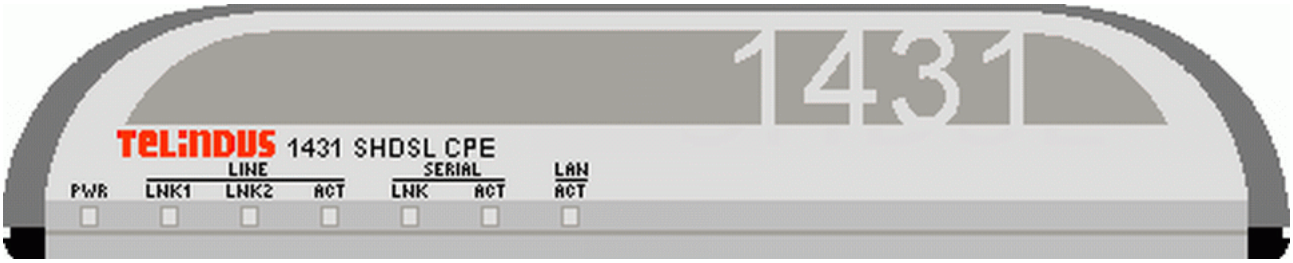
This section gives an overview of the front panel LEDs and what they indicate. The following gives an overview of this section:

- 2.7.1 - Introducing the front panel LEDs on page 25
- 2.7.2 - The power LED (PWR, green) on page 26
- 2.7.3 - The line link LED (LINE LNK1 / LNK2, green) on page 26
- 2.7.4 - The line data LED (LINE ACT, green) on page 26
- 2.7.5 - The serial link LED (SERIAL LNK, green) in case of a G703 interface on page 27
- 2.7.6 - The serial data LED (SERIAL ACT, green) in case of a G703 interface on page 27
- 2.7.7 - The serial link LED (SERIAL LNK, green) in case of a serial interface on page 28
- 2.7.8 - The serial data LED (SERIAL ACT, green) in case of a serial interface on page 28
- 2.7.9 - The LAN LED (LAN ACT, green) on page 28f

2.7.1 Introducing the front panel LEDs

When all the connections are made and the Telindus 1431 SHDSL CPE is powered, the LEDs on the front panel reflect the actual status of the device.

The following figure shows the front panel LED indicators of the Telindus 1431 SHDSL CPE:



LED states

One front panel LED can reflect different status modes by the way it lights up. The front panel LEDs can light up as follows:

LED state	LED duty cycle	Description
continuously off	0 %	The LED never lights up.
continuously on	100 %	The LED lights up continuously.
blinking	50 %	The LED is as much lit as it is out.
flashing	20 %	The LED only lights up during 20% of the time.
mostly off	-	The LED occasionally lights up, without a fixed duty cycle.
mostly on	-	The LED occasionally goes out, without a fixed duty cycle.
monitoring	-	The LED lights up irregularly. For instance, it lights up on detection of a certain signal. I.e. it monitors this signal.

2.7.2 The power LED (PWR, green)

The power LED indicates the following:

LED status	Description
continuously off	No DC input power is available.
blinking	The self test, performed during the boot sequence, failed. In this condition, the ACT LEDs are continuously on.
continuously on	The Telindus 1431 SHDSL CPE is powered and the boot sequence has been completed successfully. In case the Telindus 1431 SHDSL CPE remains in boot mode, also the ACT LEDs are continuously on to indicate this special state. Refer to 20.1 - What is boot, loader and application software? on page 802 for more information on boot mode.

2.7.3 The line link LED (LINE LNK1 / LNK2, green)

This LED reflects the status of the line:

LED status	Description
continuously off	No response on the handshake. E.g. nothing is connected to the line.
blinking	The handshake is in progress.
continuously on	The handshake was successful. Layer 1 is up.

The LINE LNK2 LED is only present on a Telindus 1431 SHDSL CPE 2 pair version.

2.7.4 The line data LED (LINE ACT, green)

This LED reflects the status of the user data on the line:

LED status	Description
continuously off	Layer 2 is down.
monitoring	Layer 2 is up and user data is present (both transmit and receive data).
continuously on	Layer 2 is up, but no user data is present.

2.7.5 The serial link LED (SERIAL LNK, green) in case of a G703 interface

In case a modular G703 interface is inserted in the interface slot, then this LED reflects the status of the link on the G703 interface:

LED status	Description
continuously off	In case the G703 interface is in … • unframed mode: Loss Of Synchronisation (LOS) or Alarm Indication Signal (AIS, also called “all ones”) is received on the interface. • framed mode: Loss Of Synchronisation (LOS), Loss of Frame Alignment (LFA) or Alarm Indication Signal (AIS, also called “all ones”) is received on the interface.
continuously on	In case the G703 interface is in … • unframed mode: no LOS or AIS is received on the interface. • framed mode: layer 1 (G.704 framing) is up.

2.7.6 The serial data LED (SERIAL ACT, green) in case of a G703 interface

In case a modular G703 interface is inserted in the interface slot, then this LED reflects the status of the user data on the G703 interface:

LED status	Description
continuously off	Layer 2 is down. In case of CES, the SERIAL ACT LED is always off (no layer 2).
monitoring	Layer 2 is up and user data is present (both transmit and receive data).
continuously on	Layer 2 is up, but no user data is present.

If the G703 interface has multiple logical interfaces (channelised E1), then the SERIAL ACT LED indicates only the status for the first logical interface (i.e. channel) on this physical interface.

2.7.7 The serial link LED (SERIAL LNK, green) in case of a serial interface

In case a modular serial interface (e.g. V35, V36, X21 or RS530) is inserted in the interface slot, then this LED reflects the status of the link on the serial interface:

LED status	Description
continuously off	The Clear To Send signal (CTS) is not present. I.e. nothing is connected to the interface.
continuously on	The CTS signal is present.

2.7.8 The serial data LED (SERIAL ACT, green) in case of a serial interface

In case a modular serial interface (e.g. V35, V36, X21 or RS530) is inserted in the interface slot, then this LED reflects the status of the user data on the serial interface:

LED status	Description
continuously off	Layer 2 is down. In case of CES, the SERIAL ACT LED is always off (no layer 2).
monitoring	Layer 2 is up and user data is present (both transmit and receive data).
continuously on	Layer 2 is up, but no user data is present.

2.7.9 The LAN LED (LAN ACT, green)

This LED reflects the status of the link and monitors the user data on the LAN interface:

LED status	Description
continuously off	Nothing is connected to the LAN interface.
monitoring	The Ethernet link is up and there is network activity on the LAN.
continuously on	The Ethernet link is up, but there is no network activity on the LAN.

3 DIP switches of the Telindus 1431 SHDSL CPE

This chapter locates the DIP switches on the Telindus 1431 SHDSL CPE motherboard. It gives an overview of their function and it explains how to change their settings.

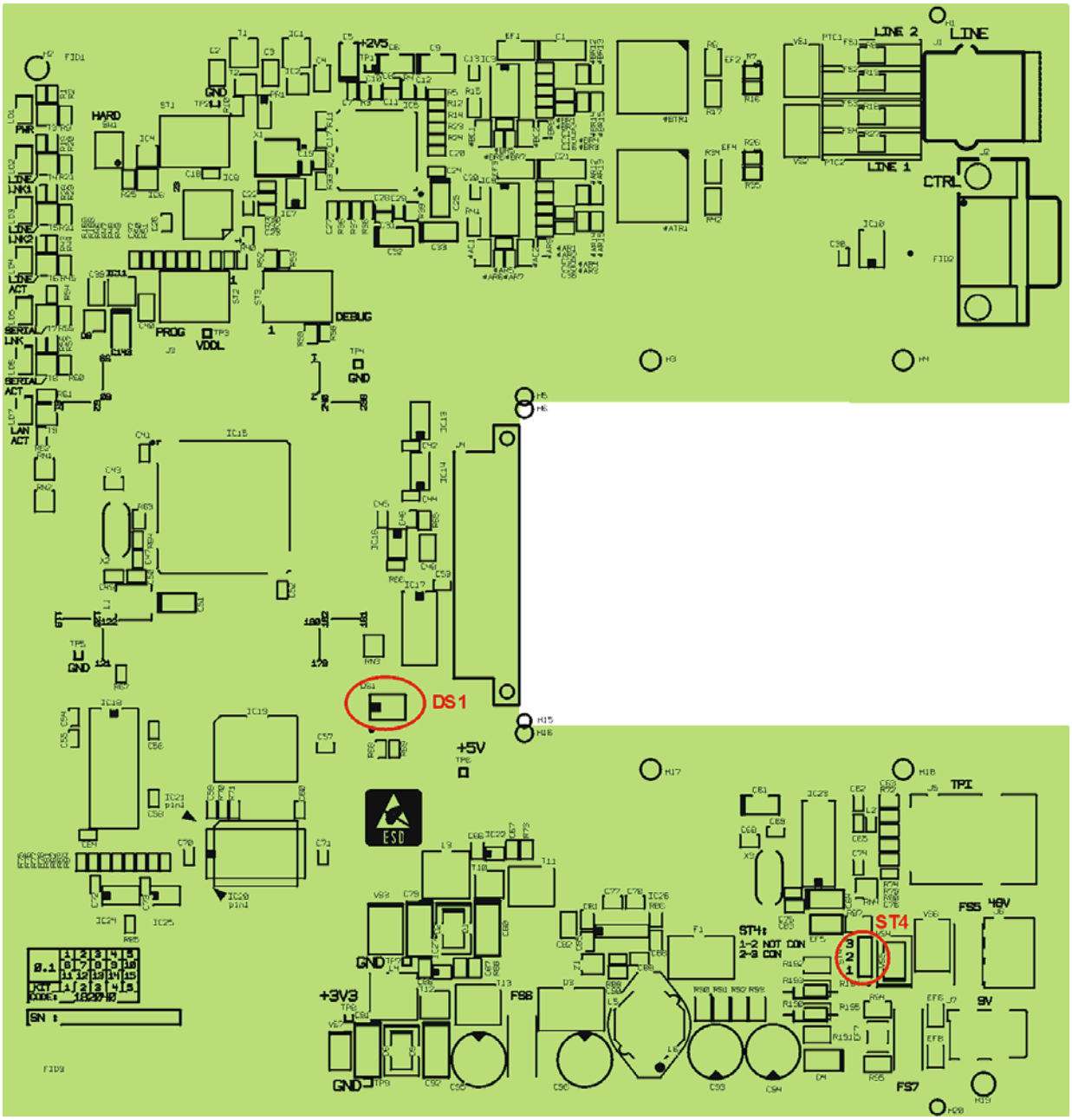
The following gives an overview of this chapter:

- 3.1 - The Telindus 1431 SHDSL CPE motherboard on page 30
- 3.2 - DIP switches of the Telindus 1431 SHDSL CPE on page 31
- 3.3 - Straps of the Telindus 1431 SHDSL CPE on page 32
- 3.4 - Opening and closing the housing on page 33

Default settings are printed in **bold**.

3.1 The Telindus 1431 SHDSL CPE motherboard

The figure below shows the position of the DIP switches and straps on the Telindus 1431 SHDSL CPE motherboard:



3.2 DIP switches of the Telindus 1431 SHDSL CPE

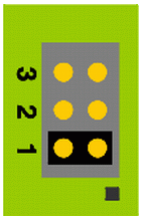
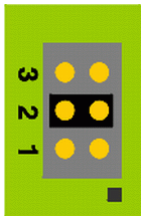
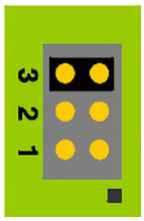
Refer to 3.4 - Opening and closing the housing on page 33 to find out how to open the housing in order to change the DIP switch settings.

The following table gives an overview of the DIP switches on DIP switch bank DS1:

DIP switch name	DS1 no.	Setting	Function
loader mode	1	**on**	Normal operation.
		off	Start up in loader mode. Refer to 20.6 - Downloading application or loader software in loader mode on page 808.
load default configuration	2	**on**	Normal operation.
		off	Load default configuration. Refer to 5.8.4 - Loading the default configuration using a DIP switch on page 87.

3.3 Straps of the Telindus 1431 SHDSL CPE

Using strap ST4, you can configure the interconnection between the signal ground and the protective ground (earth):

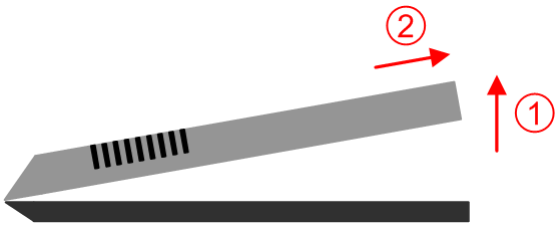
Strap settings	Connection	Description
position 1 	disconnected	By default, the signal ground is disconnected from the earth. This avoids problems which might occur when the earth potential of the Telindus 1431 SHDSL CPE and the connected application is not the same. In such a situation earth current loops may induce distortion on the transmitted data, resulting in transmission errors.
position 2 	connected through 100 ohms resistor	Sometimes you might want to connect the Telindus 1431 SHDSL CPE earth to the application earth although both earth potentials are not the same. (E.g. to avoid a big difference between both earth potentials.) To avoid that high earth currents are generated, you can make this connection through a 100 ohms resistor.
position 3 	directly connected	Sometimes it is not possible to connect the application directly to the earth. In that case you can earth the application through the Telindus 1431 SHDSL CPE by connecting the Telindus 1431 SHDSL CPE to the earth and setting the strap in position 3. Also the opposite situation might occur: it is not possible to earth the Telindus 1431 SHDSL CPE. In that case you can earth the Telindus 1431 SHDSL CPE through the application by connecting the application to the earth and setting the strap in position 3.

3.4 Opening and closing the housing

When you want to change the DIP switch settings of the Telindus 1431 SHDSL CPE, you have to open and close the housing of the Telindus 1431 SHDSL CPE. This section explains how to do so.

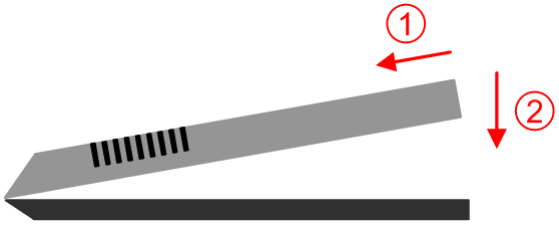
Opening the housing

To open the housing of the Telindus 1431 SHDSL CPE, proceed as follows:

Step	Action
1	Disconnect the external power supply.
2	Unscrew the two screws located at the back of the housing.
3	Remove the cover as follows: 1. Carefully lift the back of the cover a few centimetres. 2. Gently pull the cover backwards from under the nose of the housing. 

Closing the housing

To close the housing of the Telindus 1431 SHDSL CPE, proceed as follows:

Step	Action
1	Replace the cover as follows: 1. Gently push the cover under the nose of the housing. 2. Lower the back of the cover. 3. Push the back of the cover down, clicking cover and bottom together. 
2	Fasten the two screws located at the back of the housing.
3	Reconnect the external power supply.

4 Maintaining the Telindus 1431 SHDSL CPE

Once you installed the Telindus 1431 SHDSL CPE, you can proceed with the configuration of the Telindus 1431 SHDSL CPE. You can do this using any of the maintenance or management tools introduced in 1.4 - Maintenance and management tools on page 8.

This chapter briefly highlights one of those tools: the Telindus Maintenance Application (TMA). It introduces TMA and describes how to start a session on the Telindus 1431 SHDSL CPE. It also introduces the terminology concerning the management of a Telindus device. Furthermore, it explains why and how to add an object to the containment tree.

The following gives an overview of this chapter:

- 4.1 - Maintaining the Telindus 1431 SHDSL CPE with TMA on page 36
- 4.2 - Introducing the management terminology on page 42
- 4.3 - The objects in the Telindus 1431 SHDSL CPE containment tree on page 46
- 4.4 - Adding an object to the containment tree on page 49
- 4.5 - Telindus 1431 SHDSL CPE attribute overview on page 54

4.1 Maintaining the Telindus 1431 SHDSL CPE with TMA

First, this section introduces TMA. Then it describes how to start a session on the Telindus 1431 SHDSL CPE. The following gives an overview of this section:

- 4.1.1 - What is TMA? on page 37
- 4.1.2 - How to connect TMA? on page 37
- 4.1.3 - Connecting with TMA through the control connector on page 38
- 4.1.4 - Connecting with TMA over an IP network on page 40

4.1.1 What is TMA?

TMA is the acronym for Telindus Maintenance Application. TMA is a free Windows software package that enables you to maintain the Telindus 1431 SHDSL CPE, i.e. to access its configuration attributes and look at status, performance and alarm information using a user friendly graphical user interface.

TMA is an excellent tool for complete control of the Telindus access devices. When using TMA in combination with a network management system such as HP OpenView, complete networks can be managed from one central site.

Consult the TMA manual (PDF) to find out how to install TMA and to get acquainted with the user interface.

You will need a new version of the model file distribution if changes have been made to the attributes of the Telindus 1431 SHDSL CPE. The most recent model files and TMA engine can always be downloaded from the Telindus web site at www.telindusproducts.com/TMA.

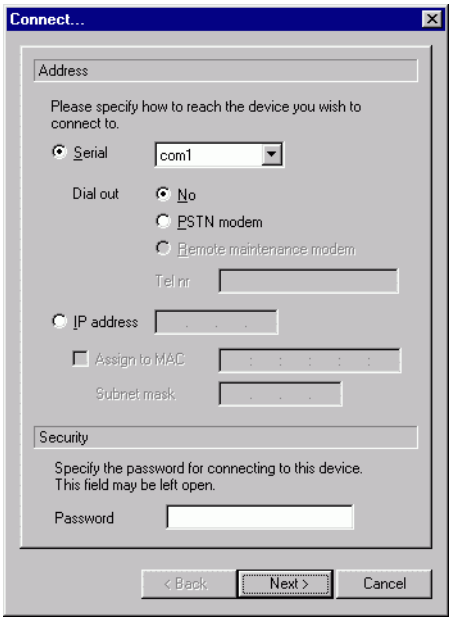
4.1.2 How to connect TMA?

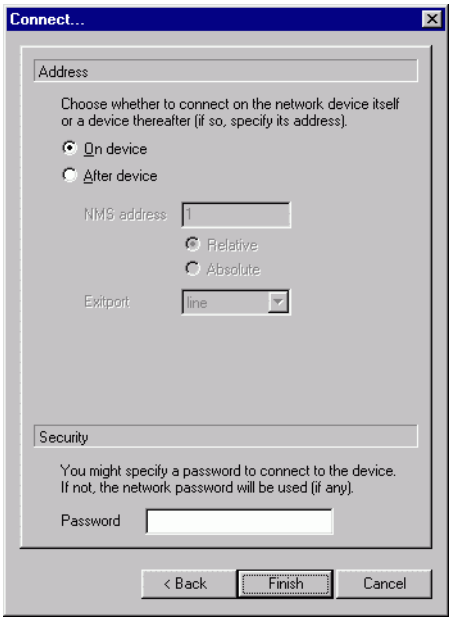
There are two ways to establish a connection between the computer running TMA and the Telindus 1431 SHDSL CPE:

- through a serial connection, i.e. through the control connector of the Telindus 1431 SHDSL CPE. Refer to 4.1.3 - Connecting with TMA through the control connector on page 38.
- through an IP connection, i.e. through the LAN connector of the Telindus 1431 SHDSL CPE. Refer to 4.1.4 - Connecting with TMA over an IP network on page 40.

4.1.3 Connecting with TMA through the control connector

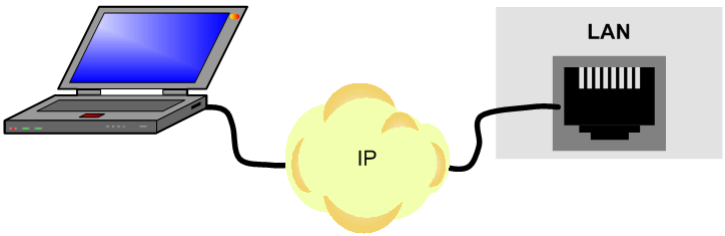
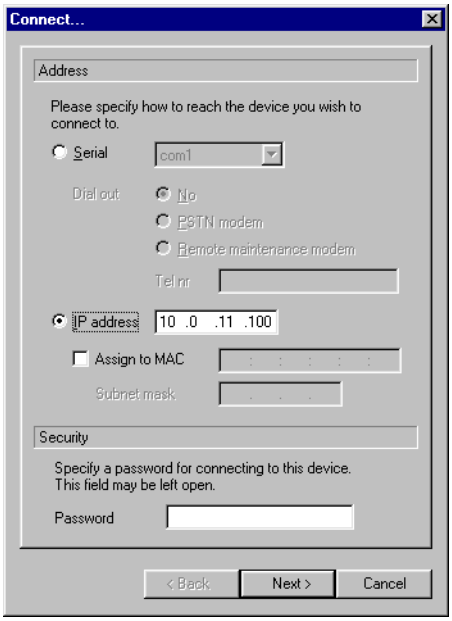
To established a connection between TMA and the Telindus 1431 SHDSL CPE through the control connector, proceed as follows:

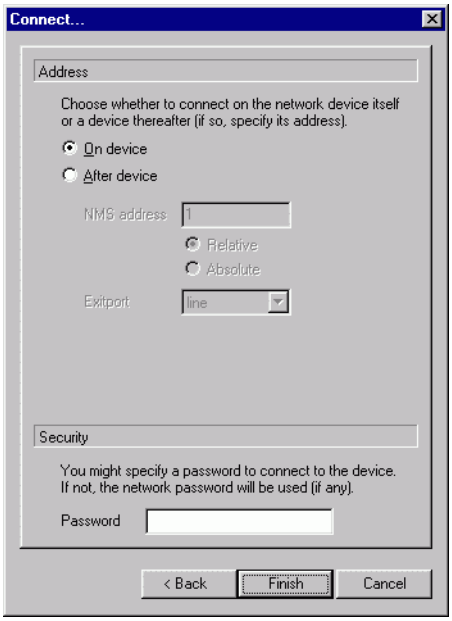
Step	Action
1	Connect a serial port of your computer (e.g. COM1) through a straight DB9 male - female cable with the control connector of the Telindus 1431 SHDSL CPE.
2	Start TMA.
3	In the TMA window, either … • select from the menu bar: *Connect* → *Device…* • or press the short-cut key: Ctrl+N • or click on the *Connect to device* button: The *Connect…* (to a device) window is displayed as in the following figure: 
4	In the *Connect…* (to a device) window, specify the following: • Select the option *Serial* and specify the COM port of your computer to which the Telindus 1431 SHDSL CPE is connected. • If previously a password has been configured in the Telindus 1431 SHDSL CPE then also fill in the password field.
5	Click on the *Next* > button. ⇒The second *Connect…* window is displayed.

Step	Action
6	In the *Connect…* (select a device) window, proceed as follows to connect to the … • local Telindus 1431 SHDSL CPE: select *On device*. • remote Telindus 1431 SHDSL CPE: - Select *After device*. - Enter 1 in the *NMS address* field. - Select *Relative*. - If previously a password has been configured in the remote Telindus 1431 SHDSL CPE then also fill in the password field.  You can only connect to a remote Telindus 1431 SHDSL CPE if the data link is up.
7	Click on the *Finish* button.
8	After a couple of seconds, the attributes of the Telindus 1431 SHDSL CPE appear in the TMA window.

4.1.4 Connecting with TMA over an IP network

To established a connection between TMA and the Telindus 1431 SHDSL CPE over an IP network, proceed as follows:

Step	Action
1	Connect the IP network to … • the network port of your PC, • the LAN connector of the Telindus 1431 SHDSL CPE. 
2	Start TMA.
3	In the TMA window, either … • select from the menu bar: *Connect* → *Device…* • or press the short-cut key: Ctrl+N • or press on the *Connect to device* button: The *Connect…* (to a device) window is being displayed as in the following figure: 
4	In the *Connect…* (to a device) window, specify the following: • Select the option *IP address* and enter the IP address of the Telindus 1431 SHDSL CPE. • If a password has previously been configured in the Telindus 1431 SHDSL CPE then also fill in the password field. Before you are able to establish a connection over an IP network, you have to configure an IP address and a default gateway in the Telindus 1431 SHDSL CPE. You can do this by first connecting TMA to the Telindus 1431 SHDSL CPE through the control connector, and then configuring an IP address and a default gateway. Refer to the 5.2 - Configuring IP addresses on page 57.
5	Click on the *Next* > button. ⇒The second *Connect…* window is displayed.

Step	Action
6	In the *Connect…* (select a device) window, proceed as follows to connect to the … • local Telindus 1431 SHDSL CPE: select *On device*. • remote Telindus 1431 SHDSL CPE: - Select *After device*. - Enter 1 in the *NMS address* field. - Select *Relative*. - If previously a password has been configured in the remote Telindus 1431 SHDSL CPE then also fill in the password field.  You can only connect to a remote Telindus 1431 SHDSL CPE if the data link is up.
7	Click on the *Finish* button.
8	After a couple of seconds, the attributes of the Telindus 1431 SHDSL CPE appear in the TMA window.

4.2 Introducing the management terminology

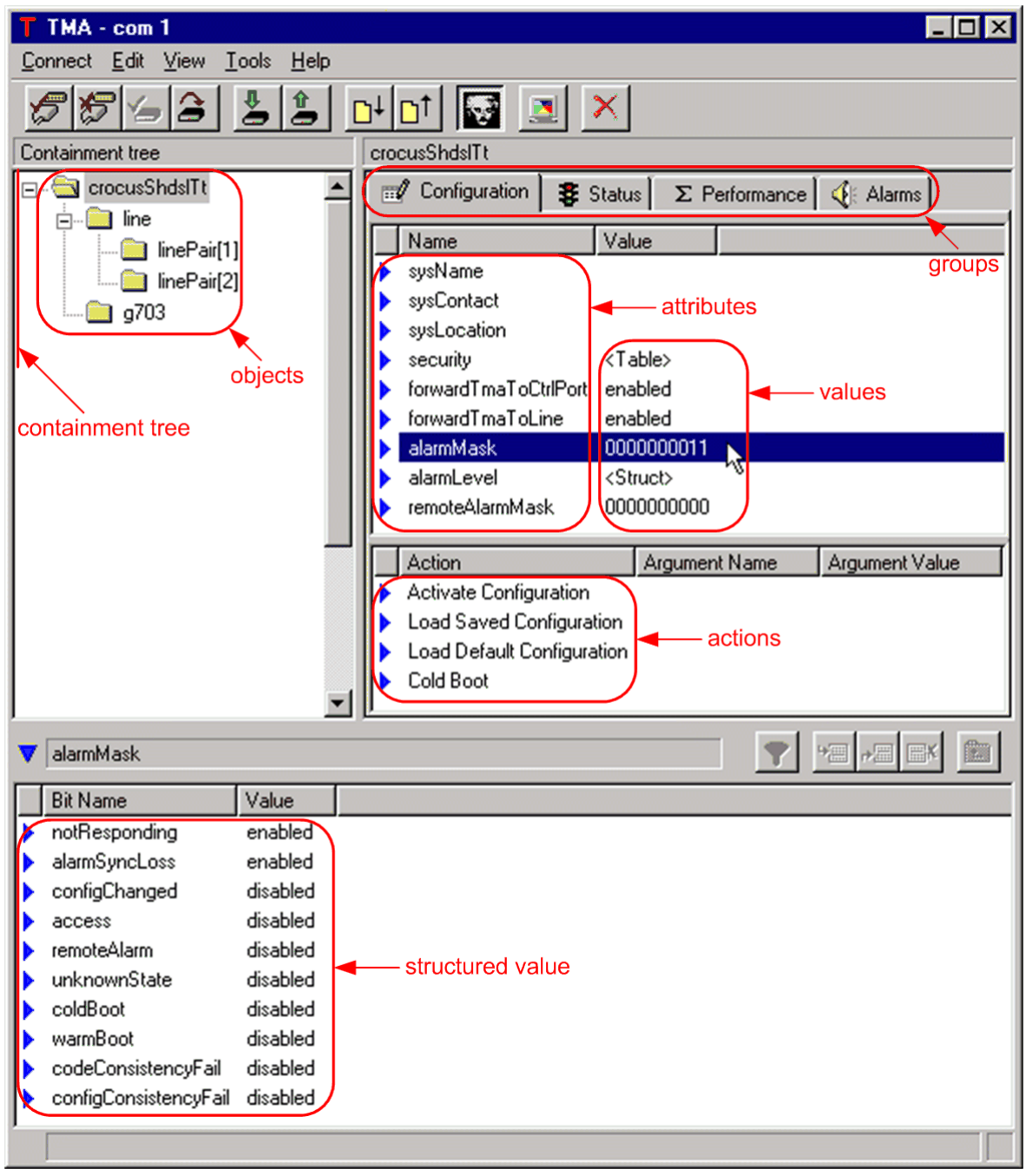
This section briefly introduces the terminology concerning the management of a Telindus device. It explains terms such as containment tree, group, object, attribute, value and action.

The following gives an overview of this section:

- 4.2.1 - Graphical representation of the containment tree on page 43
- 4.2.2 - Containment tree terminology on page 44

4.2.1 Graphical representation of the containment tree

The most comprehensible graphical representation of the containment tree is given in TMA. The following figure depicts the TMA window displaying a containment tree:



Refer to 4.2.2 - Containment tree terminology on page 44 for an explanation of the terms associated with the containment tree.

4.2.2 Containment tree terminology

Refer to 4.2.1 - Graphical representation of the containment tree on page 43 for a figure of a containment tree.

The following table explains the terminology associated with the containment tree:

Term	Description
containment tree	The containment tree represents the hierarchical structure of the Telindus 1431 SHDSL CPE. It is composed of a number of objects that are ordered in a tree. This tree resembles a Windows directory structure: • it is also a levelled structure, with nodes which can be expanded or reduced. • the containment tree objects can be compared with file folders. • the objects contain attributes like file folders contain files.
object	An object represents a physical interface, an application or a combination of both. Each object has its own set of attributes.
parent and child object	Some objects are not present in the containment tree by default. If you want to use the features associated with such an object, then you have to add the object first. You always add an object under another object. The object you add is called the child object. The object under which you add this child object is called the parent object. Objects which you can add are also often referred to as *user-instantiatable objects*.
index name	Of some objects more than one object is present in the containment tree. The different objects are distinguished from one another by adding an index. E.g. linePair[1] and linePair[2], where 1 and 2 are the indexes. Also child objects are given an index (by the user when adding the object). An index name is also often referred to as *index*, *instance value* or *instance name*.
attribute	An attribute is a parameter related to a certain object. It has a certain value.
value	An attribute has a certain value which is … • changeable in case of a configuration attribute (provided you have write access). • read only in case of a status, performance and alarm attribute.
structured value	Some attribute values contain underlying values: a structured value. These values are displayed in the structured value window. If an attribute contains structured values, then a bit string, <Table> or <Struct> is displayed after the attribute: • a bit string is a series of bits. The value of each of these bits can be 0 or 1, on or off, enabled or disabled. • a table contains columns and rows. Each column contains an attribute (which, on its turn, can have a structured value). Each row is an entry in the table. • a structure contains columns but only one row. A structure could be compared to an attribute which contains several “sub-attributes”. A structured value is also often referred to as *bit string*, *table*, *structure* or *complex value*.

Term	Description
element	An element is an attribute within a structured value. In other words, they could be considered as “sub-attributes”.
group	Groups assemble a set of attributes related by functionality. There are four groups in TMA, which correspond with the four tabs in the attribute window: • configuration, • status, • performance, • alarms.
action	A group in combination with an object may have actions assigned to them. These actions are displayed in the action window.

4.3 The objects in the Telindus 1431 SHDSL CPE containment tree

The following table lists the different objects of the Telindus 1431 SHDSL CPE containment tree. It also specifies whether the objects are present by default, whether you have to add them yourself or whether they are added automatically.

> telindus1431Router
>> lanInterface
>> wanInterface
>>> atm
>>> line
>>>> linePair[ ][1]
>>> repeater[ ][2]
>>> end[3]
>> g703[4]
>>> channel[g703_1]
>>>> atm
>>>> frameRelay
>>>> ces
>>> transpChannel[ ][5]
>>>> ces
>> <serialIf>[6]

1. In case of a Telindus 1431 SHDSL CPE 2 pair version, two linePair[ ] objects are present.
2. Not present by default. Only appears when setting the eocHandling attribute. Refer to 5.4.3 - Controlling the standard EOC message exchange on page 74.
3. Not present by default. Only appears when setting the eocHandling attribute. Refer to 5.4.3 - Controlling the standard EOC message exchange on page 74.
4. Only present when a G703 interface is used. Refer to 1.3 - Modular user interface overview on page 7.
5. Not present by default, has to be added. The index name is user defined. Refer to 4.4 - Adding an object to the containment tree on page 49.

>>> atm

>>> frameRelay

>>> ces

>> router

>>> tunnels

>>> defaultNat

>>> nat[ ][7]

>>> manualSA[ ][7]

>>> ikeSA[ ][7]

>>> routingFilter[ ][7]

>>> priorityPolicy[ ][7]

>>> trafficPolicy[ ][7]

>>> ospf

>>>> area[7]

>> bridge

>>> bridgeGroup

>>> vpnBridgeGroup[ ][7]

>>> accessList[ ][7]

>>> trafficPolicy[ ][7]

>> snmp

>> management

6. Only present when a serial interface is used. Depending on which serial interface is used, the name of this object can be rs530, v35, v36 or x21. Refer to 1.3 - Modular user interface overview on page 7.
7. Not present by default, has to be added. The index name is user defined. Refer to 4.4 - Adding an object to the containment tree on page 49.

```
>>> loopBack

>> fileSystem

>> operatingSystem
```

4.4 Adding an object to the containment tree

This section explains why and how you can add an object to the containment tree. It then explains why and how to refer to this object.

The following gives an overview of this section:

- 4.4.1 - Why add an object to the containment tree? on page 50
- 4.4.2 - How to add an object to the containment tree? on page 51
- 4.4.3 - Referring to an added object on page 53

4.4.1 Why add an object to the containment tree?

Why can you add an object to the containment tree?

Some objects are not present in the containment tree by default but you can add them yourself because …

- in this way the containment tree remains clear and surveyable,
- you possibly do not need the functions associated with such an object,
- you possibly need several of these objects so you can add as many objects as you like.

When do you have to add an object to the containment tree?

If you want to use the features associated with such an object, then you have to add the object first.

Which objects can be added to the containment tree?

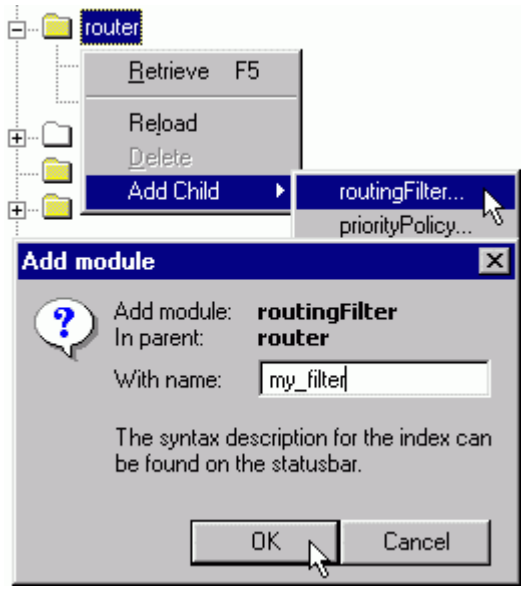
Section 4.3 - The objects in the Telindus 1431 SHDSL CPE containment tree on page 46 gives you an overview of all the objects in the containment tree. It also tells you which objects have to be added before you can use them.

4.4.2 How to add an object to the containment tree?

The section shows you, for each maintenance tool, how to add an object to the containment tree. The following section, 4.4.3 - Referring to an added object on page 53, shows you how you can “refer” to this added object somewhere else in the containment tree.

Adding an object in TMA

Step	Action
1	Right click on the parent object (e.g. router). ⇒A pop-up menu appears.
2	In the pop-up menu, select *Add Child...* and select the child object you want to add (e.g. routingFilter). ⇒A pop-up window appears.
3	In the pop-up window, type the index name (i.e. the instance value) for the child object (e.g. my_filter) and click on *OK*. ⇒The new child object is created (e.g. routingFilter[my_filter]).



Adding an object in (TMA) CLI

Step	Action
1	Enter the parent object (e.g. `select router`).
2	Type the following command: `set {select childObjectName[instanceValue]{}}` where `instanceValue` is a string of your choice. (e.g. `set {select routingFilter[my_filter]{}}`) ⇒The new child object is created.

Adding an object in ATWIN

Step	Action
1	Enter the parent object (e.g. go to the router object and press the enter key). ⇒The ATWIN window shows the sub-objects and attributes of the parent object.
2	Go to the line displaying the string <CREATE INSTANCE> and the name of the object you want to add (e.g. routingFilter <CREATE INSTANCE>) and press the enter key. ⇒A new window appears, displaying the string Give the instanceValue.
3	Press the enter key and type the index name (i.e. the instance value) for the child object (e.g. my_filter) and press the enter key again. ⇒The new child object is created (e.g. >.routingFilter [name:my_filter]).

Adding an object in the Web Interface

Step	Action
1	Enter the parent object (e.g. select the router object and double-click it or click on *Open*). ⇒The Web Interface window shows the sub-objects and attributes of the parent object.
2	Select the line displaying the string <CREATE INSTANCE> and the name of the object you want to add (e.g. routingFilter <CREATE INSTANCE>) and double-click it or click on *Open*. ⇒A new window appears, displaying the string Give the instanceValue.
3	Type the index name (i.e. the instance value) for the child object (e.g. my_filter) and click on *exit*. ⇒The new child object is created (e.g. >.routingFilter [name:my_filter]).

4.4.3 Referring to an added object

What is referring to an added object?

If at a certain place in the containment tree you want to apply the function associated with an object you added, then you have to refer to this object.

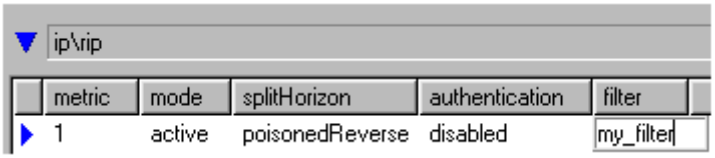
How to refer to an added object?

Some attributes allow you to enter the index name (i.e. the instance value you assigned to the object) of an added object. By doing so, the function associated with this object is applied there.

Example

Suppose you create a routingFilter object with the index name my_filter. The containment tree then looks as follows:

Now, you want to use this filter on the LAN interface. In that case, in the ip/rip structure in the lanInterface object, enter the index name of the routingFilter object under the element “filter”. This looks as follows:



4.5 Telindus 1431 SHDSL CPE attribute overview

The reference part of this manual explains all the attributes of the Telindus 1431 SHDSL CPE. One chapter describes one group of attributes:

- chapter 14 - Configuration attributes on page 379,
- chapter 15 - Status attributes on page 567,
- chapter 16 - Performance attributes on page 685,
- chapter 17 - Alarm attributes on page 753.

5 Basic configuration

This chapter shows you how to configure the very basics of the Telindus 1431 SHDSL CPE. This will allow you to access the Telindus 1431 SHDSL CPE over an IP connection with, for example, TMA. It also explains how to configure passwords on the Telindus 1431 SHDSL CPE. Furthermore, there is a section on configuration actions, i.e. how to activate a configuration, how to load the default configuration, etc. Another section redirects you to the explanation of the major features of the Telindus 1431 SHDSL CPE. The last section briefly explains what to check should you experience trouble when installing, configuring or operating the Telindus 1431 SHDSL CPE.

The following gives an overview of this chapter:

- 5.1 - What is an interface? on page 56
- 5.2 - Configuring IP addresses on page 57
- 5.3 - Configuring the SHDSL line on page 68
- 5.4 - Enabling EOC message exchange on page 72
- 5.5 - Configuring the clocking on the modular interfaces on page 80
- 5.6 - Adding CES channels on the G703 interface on page 82
- 5.7 - Configuring passwords on page 83
- 5.8 - Executing configuration actions on page 85
- 5.9 - Configuring the major features of the Telindus 1431 SHDSL CPE on page 89
- 5.10 - Troubleshooting the Telindus 1431 SHDSL CPE on page 91

Refer to the Reference manual on page 377 for a complete overview of all the attributes of the Telindus 1431 SHDSL CPE.

5.1 What is an interface?

The term interface, as it is used in this manual, can be divided into two groups:

Interface type	Description
physical	A physical interface is an interface to which you can physically connect a cable. So a physical interface has a physical connector. It also has some configuration attributes that control the behaviour of the interface. For example: • The control interface (CTRL). It has a female 9-pins subD connector to which you can connect a male 9-pins subD connector for maintenance purposes. It has configuration attributes such as ctrlPortProtocol, cms2Address, etc. • The LAN interface (LAN). It has a female RJ45 connector to which you can connect a male RJ45 connector to connect to an Ethernet network. It has configuration attributes such as ip, vlan, etc. Other examples are the station clock interface, the alarm interfaces, the xDSL line interfaces, etc.
logical	A logical interface is an interface to which you can not physically connect a cable. So a logical interface has no physical connector. However, it is part of the physical interface, but on a higher level. One physical interface can “contain” several logical interfaces. A logical interface also has some configuration attributes that control the behaviour of the interface. For example: • An ATM PVC on an xDSL line. The xDSL line is the physical interface (it has a physical connector) whereas the ATM PVC is the logical interface (it is located on a higher level, i.e. layer 2 protocol level). You can have several ATM PVCs on one xDSL line. • a VLAN on the LAN interface. The LAN interface is the physical interface and the VLAN is the logical interface. Other examples are L2TP tunnels, links in a multi-link bundle, bridge groups, etc.

5.2 Configuring IP addresses

The first thing you have to configure are the IP addresses of the Telindus 1431 SHDSL CPE. First this section lists which mechanisms there are to obtain an IP address automatically. Then it shows you, for each interface, where you can find the IP related parameters. Finally this section explains these IP related parameters.

The following gives an overview of this section:

- 5.2.1 - Automatically obtaining an IP address on page 58
- 5.2.2 - Where to find the IP parameters? on page 59
- 5.2.3 - Explaining the ip structure on page 60
- 5.2.4 - Configuring an IP address on the LAN interface on page 66

5.2.1 Automatically obtaining an IP address

Obtaining an IP address on the LAN interface

The Telindus 1431 SHDSL CPE supports several protocols to automatically obtain an IP address on its LAN interface. Refer to 19 - Auto installing the Telindus 1431 SHDSL CPE on page 775 for more information on auto-install.

Obtaining an IP address on the WAN interface

In case of …

- ATM, refer to …
  - 9.1.4 - Automatically obtaining IP addresses in ATM on page 142.
  - 19.3.2 - Auto-install in case of ATM on page 785.
- PPP(oA), refer to 9.4.2 - Automatically obtaining IP addresses in PPP on page 171.

An IP address that is obtained using a dynamic procedure is not displayed in the configuration window, but can be found in the status window.

5.2.2 Where to find the IP parameters?

The following table shows where you can find the IP parameters of the different IP interfaces:

Interface	Location of the IP parameters
LAN interface	In the ip structure of the lanInterface object: telindus1431Router/lanInterface/ip. **Important remark** If you set the configuration attribute telindus1431Router/lanInterface/mode to bridging, then the settings of the configuration attribute telindus1431Router/lanInterface/ip are ignored. As a result, if you want to manage the Telindus 1431 SHDSL CPE via IP, you have to configure an IP address in the bridgeGroup object instead: telindus1431Router/bridge/bridgeGroup/ip.
VLAN on the LAN interface	In the ip structure of the vlan table which is located in the lanInterface object: telindus1431Router/lanInterface/vlan/ip.
ATM PVC	In the ip structure of the pvcTable which is located in the atm object: telindus1431Router/wanInterface/atm/pvcTable/ip.
L2TP tunnel	In the ip structure of the l2tpTunnels table which is located in the tunnels object: telindus1431Router/router/tunnels/l2tpTunnels/ip.
IPSEC L2TP tunnel	In the ip structure of the ipsecL2tpTunnels table which is located in the tunnels object: telindus1431Router/router/tunnels/ipsecL2tpTunnels/ip.
bridge group	In the ip structure of the bridgeGroup object: telindus1431Router/bridge/bridgeGroup/ip.
management loopback	In the ipAddress attribute of the loopback object: telindus1431Router/management/loopback/ipAddress.

Refer to 5.2.3 - Explaining the ip structure on page 60 for a detailed description of the ip structure.

5.2.3 Explaining the ip structure

Because the ip structure occurs in several objects, it is described here once and referenced where necessary. Refer to 5.2.2 - Where to find the IP parameters? on page 59 for the location of the ip structure.

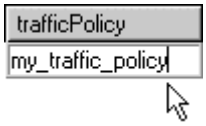
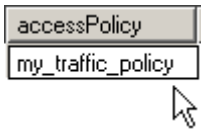
This section lists all the elements that can be present in the ip structure. However, depending on the interface, it is possible that not all of these elements are present.

The ip structure contains the following elements:

Element	Description
address	Use this element to assign an IP address to the interface. The address should belong to the subnet the interface is connected to. Default:0.0.0.0 Range: up to 255.255.255.255 If you do not explicitly configure a local IP address using the address element, then it can be learned. Refer to 5.2.1 - Automatically obtaining an IP address on page 58. An IP address that is obtained using a dynamic procedure is not displayed in the configuration window, but can be found in the status window.
netMask	Use this element to assign an IP subnet mask to the interface. The subnet mask defines the number of IP devices that may be present on the corresponding IP segment. Default:255.255.255.0 Range: up to 255.255.255.255
dhcpClient	Use this element to enable or disable the sending of DHCP client requests on the interface. Default:enabled Range: enabled / disabled
secondaryIp	Use this element to create additional virtual networks on the same Ethernet interface. Default:<empty> Range: table, see below The secondaryIp table contains the elements address and netMask. See above for an explanation of these elements.
remote	Use this element to assign an IP address to the remote end of a connection (e.g. the remote end of an L2TP tunnel, a PPP link, etc.). Default:0.0.0.0 Range: up to 255.255.255.255 If you do not explicitly configure a remote IP address using the remote element, then it can be learned. Refer to 5.2.1 - Automatically obtaining an IP address on page 58. An IP address that is obtained using a dynamic procedure is not displayed in the configuration window, but can be found in the status window.

Element	Description
acceptLocAddr	In case of a PPP link, it is possible to learn the local IP address from the remote side. Use the acceptLocAddr element to determine whether to accept or reject the learned IP address. Default:enabled Range: enabled / disabled The acceptLocAddr element has the following values: • enabled. If the remote side is able to give an IP address, then the local IP address is learned from the remote side. Even if you explicitly configure a local IP address (e.g. using the address element). In other words, if the acceptLocAddr element is set to enabled, then the local IP address that has been configured is overruled by the one that has been learned. • disabled. The local IP address can not be learned from the remote side. Also see 9.4.2 - Automatically obtaining IP addresses in PPP on page 171. An IP address that is obtained using a dynamic procedure is not displayed in the configuration window, but can be found in the status window.
acceptRemAddr	In case of a PPP link, it is possible to learn the remote IP address from the remote side. Use the acceptRemAddr element to determine whether to accept or reject the learned IP address. Default:enabled Range: enabled / disabled The acceptRemAddr element has the following values: • enabled. If the remote side is able to give an IP address, then the remote IP address is learned from the remote side. Even if you explicitly configure a remote IP address (e.g. using the remote element). In other words, if the acceptRemAddr element is set to enabled, then the remote IP address that has been configured is overruled by the one that has been learned. • disabled. The remote IP address can not be learned from the remote side. Also see 9.4.2 - Automatically obtaining IP addresses in PPP on page 171. An IP address that is obtained using a dynamic procedure is not displayed in the configuration window, but can be found in the status window.
unnumbered	In case you do not explicitly configure a local IP address for a PPP(oA) link using the address element, then you can use the unnumbered element to "borrow" the IP address of another interface for which an IP address is already configured, thereby conserving network and address space. Default:<empty> Range: 0 ... 24 characters Do this by entering the interface name as unnumbered element value. unnumbered lan

Element	Description
gatewayPreference	In case you do not explicitly configure a local or remote IP address for a PPP(oA) link using the address and remote element, then these addresses can be learned from the remote side. What is more, this route is automatically installed as default route to the remote. In that case you can use the gatewayPreference element to set the preference of this default route. Refer to the element preference on page 471 for more information. Default:80 Range: 0 ... 90 Note that if you set the gatewayPreference element to 0, then the route is not installed.
mtu	Use this element to set the Maximum Transmission Unit of the interface. Default:1500 Range: 500 ... 1650 **What is MTU?** The Maximum Transmission Unit (MTU) is the largest size packet or frame, specified in octets (eight-bit bytes), that can be sent in a packet- or frame-based network (e.g. the Internet). In case of the Internet, it is the Transmission Control Protocol (TCP) that uses the MTU to determine the maximum size of each packet in any transmission. An MTU that is too large may result in retransmissions if the packet encounters a router that cannot handle that large a packet. An MTU that is too small results in relatively more header overhead and more acknowledgements that have to be sent and handled. The Ethernet standard MTU is 1500. The Internet de facto standard MTU is 576, but ISPs often suggest using 1500. For protocols other than TCP, different MTU sizes may apply. IP packets with a size larger than the MTU and with the DF (Don't Fragment) bit set are dropped and an ICMP destination unreachable (type 3, code 4) message is sent.
rip	Use this element to configure the RIP related parameters of the interface. Default:- Range: structure, see below Refer to 10.5.3 - Explaining the rip structure on page 207 for a detailed description of the rip structure.

Element	Description
trafficPolicy	Use this element to apply a traffic policy on the routed data on the interface. Default:<empty> Range: 0 ... 24 characters Do this by entering the index name of the traffic policy you want to use. You can create the traffic policy itself by adding a trafficPolicy object and by configuring the attributes in this object. **Example** If you created a trafficPolicy object with index name my_traffic_policy (i.e. trafficPolicy[my_traffic_policy]) and you want to apply this traffic policy here, then enter the index name as value for the trafficPolicy element.  Refer to … • 10.8 - Configuring traffic and priority policy on the router on page 238 for more information on policies. • 12.2 - Configuring the access restrictions on page 294 for more information on outbound access lists.
accessPolicy	Use this element to apply an access policy on the routed data on the interface. Default:<empty> Range: 0 ... 24 characters Whereas by using the trafficPolicy element you can apply an *outbound* access list on the interface, you can apply an *inbound* access list on the interface by using the accessPolicy element. Do this by entering the index name of the traffic policy you want to use. You can create the traffic policy itself by adding a trafficPolicy object and by configuring the attributes in this object. **Example** If you created a trafficPolicy object with index name my_traffic_policy (i.e. trafficPolicy[my_traffic_policy]) and you want to apply this traffic policy here, then enter the index name as value for the trafficPolicy element.  Refer to 12.2 - Configuring the access restrictions on page 294 for more information on inbound access lists.
mgmtAccess	Use this element to enable or disable management access through this interface. Default:enabled Range: enabled / disabled If you set the mgmtAccess attribute to disabled, then you can not access the protocol stack through this interface.

Element	Description
directedBroadcasts	Use this element to enable (forward) or disable (discard) directed broadcasts. Default:enabled Range: enabled / disabled **What is a directed broadcast?** A directed broadcast is an IP packet destined for a complete (sub-)network. For example, a packet destined for all devices on subnetwork 192.168.48.0 with subnet mask 255.255.255.0 has destination address 192.168.48.255. I.e. all ones in the subnet area of the IP address.
icmpRedirects	Use this element to enable or disable the transmission of ICMP messages. Default:enabled Range: enabled / disabled **What is an ICMP redirect?** If icmpRedirects is enabled and if the Telindus 1431 SHDSL CPE receives an IP packet on the interface for which … • the next hop gateway is on the same interface, • the next hop address is in the same subnet as the source, … then it sends an ICMP message to the originator of the packet to inform him that a better (shorter) route exists.
igmp	Use this element to configure the multicasting IGMP protocol. Default:disabled Range: enumerated, see below The igmp element has the following values: • disabled. IGMP is disabled on this interface. • proxy. - IGMP join and leave messages are transmitted on this interface according to the multicast member list. - Multicast frames are always forwarded on this interface. • router. - IGMP join and leave messages are interpreted on this interface and the multicast member list is adapted accordingly. - Multicast frames are forwarded on this interface if they are present in the multicast member list. Refer to What is IGMP? and IGMP topology on page 635 for more information on IGMP.

Element	Description
helpers	Use this element to enable broadcast forwarding. Default:<empty> Range: table, see below Limited IP broadcasts (address 255.255.255.255) and (sub-)network broadcasts for a directly connected network are normally not forwarded by the Telindus 1431 SHDSL CPE. However, client / server applications often use these broadcasts during start-up to discover the server on the network. If the server is on a remote LAN, then the detection may fail. Therefore, if you configure a helper IP address, the received broadcasts address is replaced by this helper IP address and the packets are re-routed using the destination address. Multiple helper IP addresses can be configured. The Telindus 1431 SHDSL CPE only substitutes addresses for the protocols which are selected in the helperProtocols attribute. Refer to telindus1431Router/router/helperProtocols on page 476.
nat	Use this element to enable Network Address Translation on the interface. Default:<empty> Range: 0 ... 24 characters Do this by entering the name of the NAT object you want to apply: • If you want to apply the NAT settings as defined in the router/defaultNat object, then enter the string “default“ as value for the nat element. • If you want to apply the NAT settings as defined in a NAT object you added yourself (e.g. router/nat[myNat]), then enter the index name of the NAT object (in this case “myNat”) as value for the nat element. Refer to … • 10.7 - Configuring address translation on page 220 for more information on NAT. • 14.9.2 - NAT configuration attributes on page 487 for a detailed description of the NAT configuration attributes. **Important remark** If you want to enable NAT on an interface but you also want that the interface is inspected by the firewall, then enable NAT in the policies of the firewall and *not* in the ip structure of the interface.

5.2.4 Configuring an IP address on the LAN interface

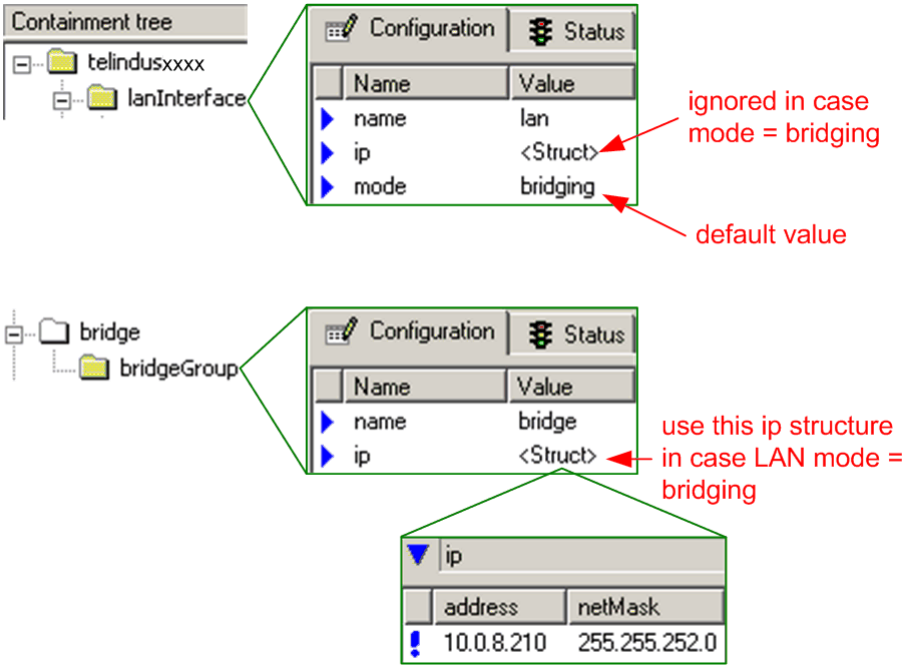
When configuring an IP address on the LAN interface, there are two different scenarios:

- The LAN interface mode is *bridging* (the configuration attribute telindus1431Router/lanInterface/mode is set to bridging). This is the default setting.
- The LAN interface mode is *routing* (the configuration attribute telindus1431Router/lanInterface/mode is set to routing).

LAN interface mode = bridging

In this case the settings of the configuration attribute telindus1431Router/lanInterface/ip are ignored. If you want to manage the Telindus 1431 SHDSL CPE via IP, then you have to configure an IP address in the bridgeGroup object instead: telindus1431Router/bridge/bridgeGroup/ip.

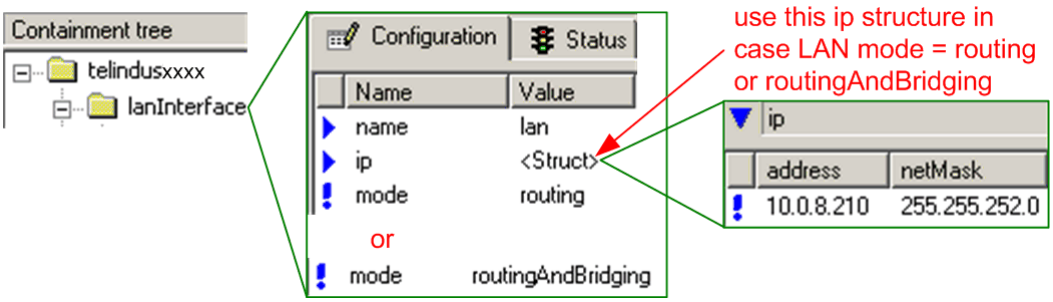
Suppose you want to assign IP address 10.0.8.210 with subnet mask 255.255.252.0 to the LAN interface, then configure the appropriate attributes as follows:



LAN interface mode = routing

In this case the settings of the configuration attribute telindus1431Router/lanInterface/ip are used.

Suppose you want to assign IP address 10.0.8.210 with subnet mask 255.255.252.0 to the LAN interface, then configure the appropriate attributes as follows:



5.3 Configuring the SHDSL line

When you want to establish a line connection successfully, you have to configure some line attributes. This section shows you which line attributes are essential. It also gives more information on how to select a line speed (range). Then it explains the concept power back-off. Finally it explains how to configure the Embedded Operations Channel (EOC) handling.

The following gives an overview of this section:

- 5.3.1 - Essential SHDSL line configuration attributes on page 69
- 5.3.2 - Selecting an SHDSL line speed (range) on page 70
- 5.3.3 - Power back-off on page 70
- 5.3.4 - Using a repeater on the SHDSL line on page 71
- 5.3.5 - Compatibility with other SHDSL devices on page 71

5.3.1 Essential SHDSL line configuration attributes

To establish a line connection successfully, it is essential to set the following configuration attributes correct:

Attribute	Purpose of the attribute
telindus1431Router/wanInterface/line/channel on page 444	For synchronisation purposes, one unit has to be defined as *central* and its remote counterpart as *remote*. In case of CES, the channel attribute also influences the clocking of the Telindus 1431 SHDSL CPE.
telindus1431Router/wanInterface/line/region on page 444	For correct operation, select the correct SHDSL standard. Normally, the auto setting should suffice.
In case of a Telindus 1431 SHDSL CPE 1pair version, use: • telindus1431Router/wanInterface/line/minSpeed on page 447 • telindus1431Router/wanInterface/line/maxSpeed on page 447 In case of a Telindus 1431 SHDSL CPE 2 pair version, use: • telindus1431Router/wanInterface/line/minSpeed2P on page 448 • telindus1431Router/wanInterface/line/maxSpeed2P on page 448	For a successful and qualitative line connection, select an appropriate speed (range). Refer to 5.3.2 - Selecting an SHDSL line speed (range) on page 70 for more information on the speed (range).

Refer to 14.6 - SHDSL line configuration attributes on page 443 for a complete overview of the line configuration attributes.

5.3.2 Selecting an SHDSL line speed (range)

Selecting a speed range

The Telindus 1431 SHDSL CPE features auto speed negotiation according to ITU-T G.994.1. During this negotiation the Telindus 1431 SHDSL CPE selects a speed within the range from the minimum speed up to the maximum speed as set with the minSpeed(2P) and maxSpeed(2P) attributes.

Important remark

In case of a Telindus 1431 SHDSL CPE 2 pair version, define a speed range *either* on the central *or* on the remote Telindus 1431 SHDSL CPE, *but not on both*. Else the 2 line pairs could train at a different speed which is not allowed.

Selecting a fixed speed

If you set the minSpeed(2P) and maxSpeed(2P) attribute to the same value, then the Telindus 1431 SHDSL CPE operates at a fixed speed.

Fall-back speed

When you define a speed range, the Telindus 1431 SHDSL CPE will always try to operate at the maximum speed. If the remote does not allow that speed or the signal quality deteriorates, then the Telindus 1431 SHDSL CPE tries to select the second speed down the range. If also this speed fails, the Telindus 1431 SHDSL CPE again lowers its speed. It does this until it reaches the minimum speed.

5.3.3 Power back-off

The Telindus 1431 SHDSL CPE features power back-off. Power back-off is a part of the ITU-T G.991.2 SHDSL recommendation. It reduces the maximum transmit power level if the line conditions are sufficiently good to operate at a lower transmit level.

Power back-off is performed by default (no configuration attribute). During the ITU-T G.994.1 handshake, the two sides of the line mutually agree on the transmit level. The transmit level is lowered between 0 and 6 dB in steps of 1dB.

5.3.4 Using a repeater on the SHDSL line

The Telindus 1431 SHDSL CPE can not operate with the current Crocus SHDSL Repeater. This because the Telindus 1431 SHDSL CPE always operates in synchronous mode on the SHDSL line. The Crocus SHDSL Repeater can only operate in plesiochronous mode on the SHDSL line.

5.3.5 Compatibility with other SHDSL devices

The Telindus 1431 SHDSL CPE can be used in combination with other (Telindus) SHDSL devices. The document “Interoperability for Telindus SHDSL products” (PDF) gives an overview of the interoperability.

5.4 Enabling EOC message exchange

This section introduces EOC message exchange and shows you how to enable this feature.

The following gives an overview of this section:

- 5.4.1 - Standard versus proprietary EOC message exchange on page 73
- 5.4.2 - Controlling the proprietary EOC message exchange on page 73
- 5.4.3 - Controlling the standard EOC message exchange on page 74
- 5.4.4 - Which standard EOC information is retrieved? on page 76

5.4.1 Standard versus proprietary EOC message exchange

On the Telindus SHDSL devices you can distinguish two types of EOC message exchange:

- standard EOC message exchange. These are the messages as defined in the SHDSL standard G.991.2. They are sent through the Embedded Operations Channel (EOC).
- proprietary EOC message exchange. This is the proprietary O10 management protocol. This is also sent through the Embedded Operations Channel (EOC).

5.4.2 Controlling the proprietary EOC message exchange

The proprietary EOC message exchange can be controlled by the configuration attribute telindus1431Router/wanInterface/line/management on page 451. The management attribute has the following values:

Value	Description
transparent	No management data is forwarded over the SHDSL line. The data is passed transparently over the line.
o10Management	This forwards the proprietary Telindus O10 protocol over the SHDSL line. This allows you to manage the remote SHDSL device (and possibly other Telindus devices connected to the SHDSL device).
pathManagement	This forwards path management information over the SHDSL line. This allows you to manage complete paths instead of managing individual devices (i.e. elements). For more information on path management, refer to the TMA Path Management manual (PDF).
o10-PathManagement	This forwards both the proprietary Telindus O10 protocol as the path management information over the SHDSL line.

5.4.3 Controlling the standard EOC message exchange

The standard EOC message exchange can be controlled by the configuration attribute telindus1431Router/wanInterface/line/eocHandling on page 451. The eocHandling attribute has the following values:

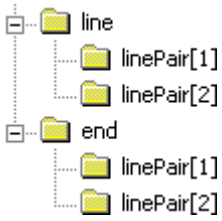
Value	Description
passive	The Telindus 1431 SHDSL CPE does not send any standard EOC messages. However, the Telindus 1431 SHDSL CPE does respond on standard EOC messages it receives. Also, after getting into data state, no proprietary EOC messages will be sent for the first 2 minutes, unless the Telindus 1431 SHDSL CPE received a Telindus specific frame from the other side (e.g. O10 data, or a test or configuration frame). This is the preferred value when connecting the Telindus 1431 SHDSL CPE to the Telindus 2300 Series.
none	Except for discovery probes, the Telindus 1431 SHDSL CPE does not send standard EOC messages. However, the Telindus 1431 SHDSL CPE does respond on standard EOC messages it receives.
discovery inventory info	The Telindus 1431 SHDSL CPE “scans” the SHDSL line. For every device it discovers, it adds an object to the containment tree. Refer to Discovering devices on the SHDSL line. Then the Telindus 1431 SHDSL CPE retrieves information from these devices and displays it in the corresponding objects. Exactly which information is retrieved depends on the setting of the eocHandling attribute. Refer to 5.4.4 - Which standard EOC information is retrieved? on page 76.
alarmConfiguration	Also in this case the Telindus 1431 SHDSL CPE “scans” the SHDSL line, adds the objects to the containment tree and retrieves information from the devices. Refer to Discovering devices on the SHDSL line and 5.4.4 - Which standard EOC information is retrieved? on page 76. Additionally, the central[1] SHDSL device forces the remote[2] SHDSL device to use the link alarm thresholds lineAttenuationOn and signalNoiseOn as configured on the central device. In other words, the settings of the lineAttenuationOn and signalNoiseOn on the central device overrule those of the remote device.

1. The central device is the device on which the channel attribute is set to central.
2. The remote device is the device on which the channel attribute is set to remote.

Discovering devices on the SHDSL line

When you change the eocHandling attribute from to any other value, the Telindus 1431 SHDSL CPE starts “scanning” the SHDSL line in order to determine which devices are present between itself and its remote counterpart.

So in this case, when the scan is finished, an end object is added to the containment tree[1] on the same level as the line object. This end object represents the remote counterpart.



1. It can take up to 5 minutes before the new objects appear in the containment tree.

5.4.4 Which standard EOC information is retrieved?

As said in 5.4.3 - Controlling the standard EOC message exchange on page 74, exactly which standard EOC information is retrieved from the remote SHDSL device(s) depends on the setting of the eocHandling attribute.

This section gives an overview in which case which information is retrieved:

- Standard EOC status information on page 77
- Standard EOC performance information on page 78
- Standard EOC alarm information on page 79

Standard EOC status information		**Does the attribute or element display relevant information in case** eocHandling **is set to … ?**				
Object telindus1431Router/ ...	**Attribute (Element)**	none	discovery	inventory	info	alarmConfiguration
line	eocAlarmThresholds (lineAttenuation, signalNoise)	No. The value is always 0.0.	• On the central[1]: yes. The values are those as set in the linkAlarmThresholds attribute. • On the remote[2]: no. The value is always 0.0.			Yes. The values are those as set in the linkAlarmThresholds attribute on the central device.[3]
	numDiscoveredRepeaters	Yes.				
repeater[ ] or end	vendorId (countryCode, providerCode, vendorSpecific)	No repeater[ ] or end object is created.	Yes.			
	vendorModel		No.	Yes.		
	vendorSerial		No.	Yes.		
	vendorSoftVersion		No.	Yes.		
	eocSoftVersion		Yes.			
	shdslVersion		Yes.			
	eocState		Yes.			
	eocAlarmThresholds (lineAttenuation, signalNoise)		No. The value is always 0.0.		Yes. The values are those as set in the linkAlarmThresholds attribute on the remote device.	Yes. The values are those as set in the linkAlarmThresholds attribute on the central device.
repeater[ ]/linePair[ ] or end/linePair[ ]	lineAttenuation	No repeater[ ] or end object is created.	No. The value is always 0.0.		Yes. The values are the actual line attenuation and signal noise as measured on the remote device.	
	signalNoise					

1. The central device is the device on which the channel attribute is set to central.
2. The remote device is the device on which the channel attribute is set to remote.
3. Refer to 5.4.3 - Controlling the standard EOC message exchange on page 74 for more information on the alarmConfiguration value.

Standard EOC performance information		**Does the attribute or element display relevant information in case** eocHandling **is set to ... ?**				
Object telindus1431Router/ ...	**Attribute**	none	discovery	inventory	info	alarmConfiguration
repeater[ ]/linePair[ ] or end/linePair[ ]	lineParameters	No repeater[ ] or end object is created.	No. The value is always 0.0.		Yes. The values are the same as those on the remote device. Note that in this case the sysUpTime is not the elapsed time since the last cold boot, but the elapsed time since the creation of the repeater[ ] or end object.	
	performance					
	h2LineParameters					
	h2Performance					
	h24LineParameters					
	h24Performance					
	d7LineParameters					
	d7Performance					

Standard EOC alarm information		**Does the attribute or element display relevant information in case** eocHandling **is set to … ?**				
Object telindus1431Router/ ...	**Attribute**	none	discovery	inventory	info	alarmConfiguration
line/linePair[ ]	lineAttenuation	The thresholds as configured in the linkAlarmThresholds attribute on the local device are used to generate the alarms.				The thresholds as configured in the linkAlarmThresholds attribute on the central[1] device are used to generate the alarms[2].
	signalNoise					
repeater[ ]/linePair[ ] or end/linePair[ ]	lineAttenuation	No repeater[ ] or end object is created.	No alarms are generated.		The thresholds as configured in the linkAlarmThresholds attribute on the local device are used to generate the alarms.	The thresholds as configured in the linkAlarmThresholds attribute on the central device are used to generate the alarms.
	signalNoise					
	errSecExceeded					The thresholds as configured in the linkAlarmThresholds attribute on the local device are used to generate the alarms.
	sevErrSecExceeded					

1. The central device is the device on which the channel attribute is set to central.
2. Refer to 5.4.3 - Controlling the standard EOC message exchange on page 74 for more information on the alarmConfiguration value.

5.5 Configuring the clocking on the modular interfaces

Depending on which interface is used, the clocking has to be configured on a different level. The following clarifies this.

Interface	Clocking
G703	The clocking has to be configured on interface level, regardless of the encapsulation that is used. Refer to telindus1431Router/g703/clocking on page 460.
serial (i.e. RS530, V35, V36 and X21)	The clocking has to be configured on encapsulation level, regardless of the interface that is used. In case of … • FRF, refer to telindus1431Router/<modularIf>/frameRelay/syncSettings on page 432. • CES, refer to telindus1431Router/<modularIf>/ces/syncSettings on page 437.

Important remarks on clocking on the G703 interface

In some situations not all clocking schemes are allowed. In that case the Telindus 1431 SHDSL CPE adapts its clocking automatically. The following table shows you how and in which case the Telindus 1431 SHDSL CPE adapts its clocking when you select a certain clocking scheme:

Clocking mode	FRF - actual clocking on …		CES - actual clocking on …	
	central[1]	remote[2]	central[1]	remote[2]
external	external	external	external	slaveOnNetwork
internal	internal	internal	internal	slaveOnNetwork
slaveOnNetwork	internal	slaveOnNetwork	internal	slaveOnNetwork

1. Central means the Telindus 1431 SHDSL CPE of which the configuration attribute line/channel is set to central. Refer to telindus1431Router/wanInterface/line/channel on page 444.
2. Remote means the Telindus 1431 SHDSL CPE of which the configuration attribute line/channel is set to remote. Refer to telindus1431Router/wanInterface/line/channel on page 444.

- In case you use a G703 interface in the Telindus 1431 SHDSL CPE and you use CES, external clocking mode is supported only when the Telindus 1431 SHDSL CPE dedicated G703 interface is used. Else internal clocking mode is used instead.
- In case you use CES, then make sure there is only one clock present in the system.
- In case the central Telindus 1431 SHDSL CPE is used in CES mode, it derives an 8 kHz clock from the external or internal clock and puts this clock on the line. The remote Telindus 1431 SHDSL CPE, whose actual clocking mode is slave on network, expects this 8 kHz clock. Devices of other vendors not always put this 8 kHz clock on the line.
- In case you set up two Telindus 1431 SHDSL CPEs point-to-point and you use CES, then only the central Telindus 1431 SHDSL CPE can be used in external or internal clocking mode. Refer to the table above.

Important remarks on clocking on the serial interfaces

- In some situations not all clocking schemes are allowed. In that case the Telindus 1431 SHDSL CPE adapts its clocking automatically. The following table shows you how and in which case the Telindus 1431 SHDSL CPE adapts its clocking when you select a certain clocking scheme:

Clocking mode	FRF - actual clocking on the …		CES - actual clocking on the …	
	central[1]	remote[2]	central[1]	remote[2]
external	external	external	- not possible -	- not possible -
internalPreferred	internalPreferred	internalPreferred	internalPreferred	slaveOnNetworkPreferred
internalAlternative	internalAlternative	internalAlternative	internalAlternative	slaveOnNetworkAlternative
slaveOnNetworkPreferred	internalPreferred	slaveOnNetworkPreferred	internalPreferred	slaveOnNetworkPreferred
slaveOnNetworkAlternative	internalAlternative	slaveOnNetworkAlternative	internalAlternative	slaveOnNetworkAlternative

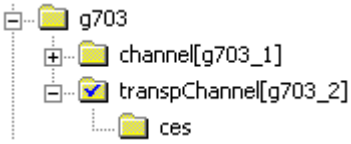
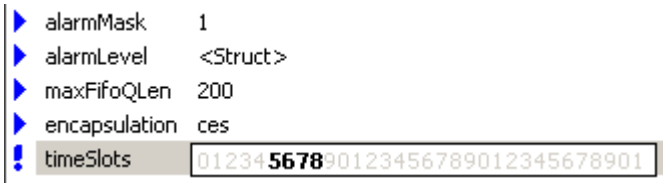
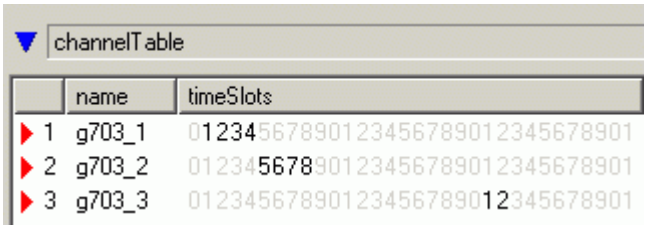
1. Central means the Telindus 1431 SHDSL CPE of which the configuration attribute line/channel is set to central. Refer to telindus1431Router/wanInterface/line/channel on page 444.
2. Remote means the Telindus 1431 SHDSL CPE of which the configuration attribute line/channel is set to remote. Refer to telindus1431Router/wanInterface/line/channel on page 444.

- In case you select a preferred clocking mode, be sure the DTE can loop back the TxClk to the DCE (becoming the ExtTxClk). Else this clocking mode does not work. No fallback from preferred to alternative clocking mode is provided.
- In case you select an alternative clocking mode, be sure to use short cables between DTE and DCE especially at high speeds. Else the TxClk and transmit data may be out of phase, which results in errors. No fallback from alternative to preferred clocking mode is provided.
- Should you experience problems when using an alternative clocking mode, you could try to invert the clock. To do this, use the attributes transmitSampleClock and receiveSampleClock. Refer to telindus1431Router/<serialIf>/transmitSampleClock on page 467 and telindus1431Router/<serialIf>/receiveSampleClock on page 467.
- In case you use CES, then make sure there is only one clock present in the system.
- In case the central Telindus 1431 SHDSL CPE is used in CES mode, it derives an 8 kHz clock from the external or internal clock and puts this clock on the line. The remote Telindus 1431 SHDSL CPE, whose actual clocking mode is slave on network, expects this 8 kHz clock. Devices of other vendors not always put this 8 kHz clock on the line.
- In case you set up two Telindus 1431 SHDSL CPEs point-to-point and you use CES, then only the central Telindus 1431 SHDSL CPE can be used in internal clocking mode. Refer to the table above.

5.6 Adding CES channels on the G703 interface

By default, the g703 object contains one channel sub-object, being channel[g703_1]. However, it is possible to add additional logical channels which can be used as CES channels. Up to 31 separate channels can be configured.

In order to add a CES channel, proceed as follows:

Step	Action
1	Make sure the telindus1431Router/g703/framing attribute is set to framed.
2	Under the g703 object, add a transpChannel object to the containment tree. Refer to 4.4 - Adding an object to the containment tree on page 49. Example: Suppose you add a transpChannel object with index name g703_2. 
3	Configure the attributes in the added logical channel to your needs. Example: Suppose you enable time slots 5 up to 8. 
4	If you have several CES channels and you want to get an overview of which time slots are already enabled and which not, then check the telindus1431Router/g703/channelTable on page 627 status attribute. Example: Suppose you have three CES channels: • channel[g703_1]: time slots 1 up to 4 are enabled. • transpChannel[g703_2]: time slots 5 up to 8 are enabled. • transpChannel[g703_3]: time slots 21 and 22 are enabled.  The channelTable status attribute gives you an overview of the used time slots on the different CES channels.

5.7 Configuring passwords

This section shows you how to create a (list of) password(s) with associated access level in the security table. It also explains how to correct the security table in case of error or in case you forgot your password. Furthermore, this section shows you how to enter the passwords in the different maintenance tools.

The following gives an overview of this section:

- 5.7.1 - Creating passwords in the security table on page 84
- 5.7.2 - Entering passwords in the different management tools on page 84

5.7.1 Creating passwords in the security table

In order to avoid unauthorised access to the Telindus 1431 SHDSL CPE and the network you can create a list of passwords with associated access levels in the security table. Do this using the security attribute. Refer to telindus1431Router/security on page 388.

5.7.2 Entering passwords in the different management tools

Now that you created a (list of) password(s) in the Telindus 1431 SHDSL CPE, you have to enter these passwords every time you want to access the Telindus 1431 SHDSL CPE with one of the maintenance or management tools.

The following table explains how to enter passwords in the different maintenance or management tools:

Maintenance or management tool	**How to enter the password?**
TMA	Enter the password in the *Connect…* window.
TMA CLI, TMA for HP OpenView and TMA Element Management	Use the application *TmaUserConf.exe* to create a TMA user and assign a password to this user. The password should correspond with a password configured in the device. Refer to the manual of TMA CLI manual (PDF), TMA for HP OpenView manual (PDF) or TMA Element Management manual (PDF/CHM) for more information.
CLI	You are prompted to enter the password when the session starts.
ATWIN	You are prompted to enter the password when the CLI session starts. Then you can start an ATWIN session.
Web Interface	You are prompted to enter the password when the session starts.
SNMP	Define the password as community string. If no passwords are defined, then you can use any string as community string.
TML	Enter the password after the destination filename. Separate password and filename by a '?'. Example: `tml -fsourcefile@destinationfile?pwd`
(T)FTP	Enter the password after the destination filename. Separate password and filename by a '?'. Example: `put sourcefile destinationfile?pwd`

5.8 Executing configuration actions

This section shows you how to execute actions on the configuration. The following gives an overview of this section:

- 5.8.1 - What are the different configuration types? on page 86
- 5.8.2 - Activating the configuration on page 87
- 5.8.3 - Loading the default configuration on page 87
- 5.8.4 - Loading the default configuration using a DIP switch on page 87
- 5.8.5 - Loading the preconfiguration on page 88

5.8.1 What are the different configuration types?

This section explains the different configuration types that are present in the Telindus 1431 SHDSL CPE.

Which are the configuration types?

Three types of configuration are present in the Telindus 1431 SHDSL CPE:

- the non-active configuration
- the active configuration
- the default configuration.
- the preconfiguration.

Explaining the configuration types

When you configure the Telindus 1431 SHDSL CPE, the following happens:

Phase	Action	Result
1	Connect the computer running the maintenance tool to the Telindus 1431 SHDSL CPE.	The non-active configuration is displayed on the screen.
2	Modify the non-active configuration.	The modifications have no immediate influence on the active configuration currently used by the Telindus 1431 SHDSL CPE.
3	Complete the modifications on the non-active configuration.	The non-active configuration has to be activated.
4	In case of … • TMA, click on the TMA button *Send all attributes to device*: . • any other maintenance tool than the graphical user interface based TMA (e.g. ATWIN, CLI, Web Interface, EasyConnect terminal, TMA CLI), then execute the Activate Configuration action.	The non-active configuration becomes the active configuration.

Which are the configuration actions?

You can execute the following actions on the configuration:

- telindus1431Router/Activate Configuration on page 390
- telindus1431Router/Load Default Configuration on page 390
- telindus1431Router/Load Preconfiguration on page 390
- telindus1431Router/Load Saved Configuration on page 391

5.8.2 Activating the configuration

As explained in section 5.8.1 - What are the different configuration types? on page 86, when you finished configuring the Telindus 1431 SHDSL CPE you have to activate the configuration changes you made.

In case of …

- TMA, click on the TMA button *Send all attributes to device*: .
- any other maintenance tool than the graphical user interface based TMA (e.g. ATWIN, CLI, Web Interface, EasyConnect terminal, TMA CLI), then execute the Activate Configuration action.

5.8.3 Loading the default configuration

If you install the Telindus 1431 SHDSL CPE for the first time, all configuration attributes have their default values (except if a preconfiguration is present, refer to 5.8.5 - Loading the preconfiguration on page 88). If the Telindus 1431 SHDSL CPE has already been configured but you want to start from scratch, then you can revert to the default configuration.

You can load the default configuration using the *Load Default Configuration* …

- action. Refer to telindus1431Router/Load Default Configuration on page 390.
- DIP switch. Refer to 5.8.4 - Loading the default configuration using a DIP switch on page 87.

5.8.4 Loading the default configuration using a DIP switch

The following procedure shows how to load the default configuration using the *Load Default Configuration* DIP switch on the Telindus 1431 SHDSL CPE PCB:

Step	Action
1	Disconnect the power supply and open the housing as described in 3.4 - Opening and closing the housing on page 33.
2	Set the *Load default configuration* DIP switch to *off*. Refer to 3.1 - The Telindus 1431 SHDSL CPE motherboard on page 30 to locate this DIP switch bank.
3	Replace the cover without fastening the screws and reconnect the power supply. ⇒The Telindus 1431 SHDSL CPE reboots and loads the default configuration.
4	Activate the loaded default configuration: 1. Open a TMA session on the Telindus 1431 SHDSL CPE. Refer to 4.1 - Maintaining the Telindus 1431 SHDSL CPE with TMA on page 36. 2. Execute the Activate Configuration action.
5	Again, disconnect the power supply and open the housing.
6	Reset the *Load default configuration* DIP switch to *on*.
7	Properly replace the cover as described in 3.4 - Opening and closing the housing on page 33 and reconnect the power supply.

Always reboot the Telindus 1431 SHDSL CPE after changing the DIP switches.

5.8.5 Loading the preconfiguration

In some cases, the Telindus 1431 SHDSL CPE is preconfigured when it leaves the factory. In that case a file named "*precfg.cms*" is present on the file system[1]. This means that not all attributes have their default values, but some will have a preconfigured value. Now, if the Telindus 1431 SHDSL CPE has already been configured a couple of times, then you have the possibility to revert to the preconfiguration.

You can load the preconfiguration using the *Load Preconfiguration* action. Refer to telindus1431Router/Load Preconfiguration on page 390.

Note that if no preconfiguration is present (i.e. the *precfg.cms* file is not present on the file system), then this action does nothing.

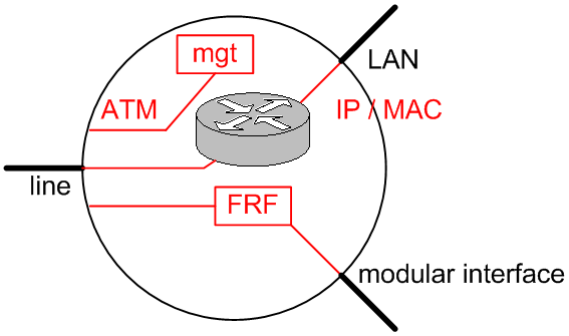
1. If this file is not present, then no preconfiguration is present. If you want, you could create your own preconfiguration by placing a custom made "*precfg.cms*" configuration file on the file system.

5.9 Configuring the major features of the Telindus 1431 SHDSL CPE

The following lists the major features of the Telindus 1431 SHDSL CPE. It also shows you where you can find an introduction to and a basic configuration of these features.

Frame Relay to ATM interworking (FRF)

The following figure schematically shows the Telindus 1431 SHDSL CPE and the encapsulation when using FRF:

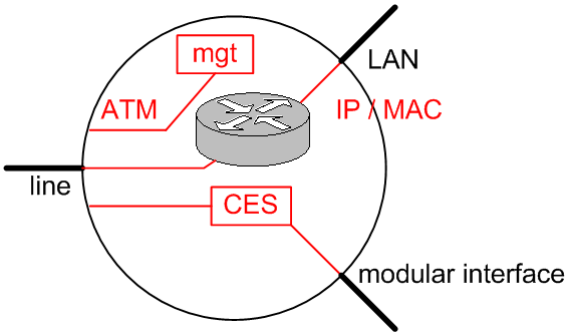


Refer to …

- 6 - Configuring Frame Relay to ATM interworking on page 93
- 9.1 - Configuring ATM encapsulation on page 128
- 9.2 - Configuring Frame Relay encapsulation on page 156

Circuit Emulation Service (CES)

The following figure schematically shows the Telindus 1431 SHDSL CPE and the encapsulation when using CES:

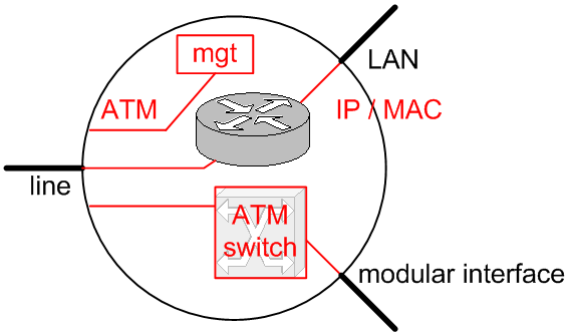


Refer to …

- 7 - Configuring Circuit Emulation Service on page 117
- 9.1 - Configuring ATM encapsulation on page 128
- 9.3 - Configuring CES encapsulation on page 164

ATM switching

The following figure schematically shows the Telindus 1431 SHDSL CPE and the encapsulation when using ATM switching:

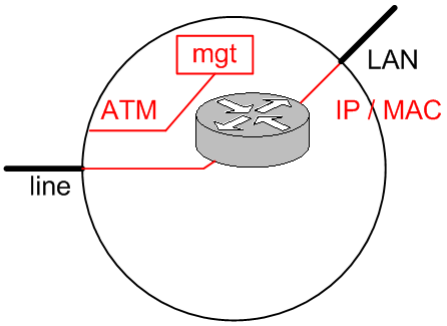


Refer to …

- 8 - Configuring ATM switching on page 123

IP bridging and routing

The following figure schematically shows the Telindus 1431 SHDSL CPE and the encapsulation for IP traffic:



Refer to …

- 9.1 - Configuring ATM encapsulation on page 128
- 9.4 - Configuring PPP encapsulation (in case of PPPo…) on page 167
- 10 - Configuring routing on page 187
- 11 - Configuring bridging on page 261
- 12 - Configuring the additional features on page 287 (e.g. configuring DHCP, access lists, VLANs, L2TP tunnels, etc.)

5.10 Troubleshooting the Telindus 1431 SHDSL CPE

If you experience trouble when installing, configuring or operating the Telindus 1431 SHDSL CPE, then check the following:

Check	Description
power	Is the Telindus 1431 SHDSL CPE powered properly?
connections	Are all the necessary cables connected to the Telindus 1431 SHDSL CPE? Are they connected to the correct connectors of the Telindus 1431 SHDSL CPE? Are they connected properly? Did you use the correct cables (straight, crossed, …)? Refer to 2.6 - Connecting the Telindus 1431 SHDSL CPE on page 18.
other devices	Are the devices that are connected to the Telindus 1431 SHDSL CPE working properly (are they powered, are they operational, …)?
LEDs	What indicate the LEDs of the Telindus 1431 SHDSL CPE? Do they indicate a fault condition? Refer to 2.7 - The front panel LED indicators on page 24.
messages	What messages are displayed in the messages table? This table displays informative and error messages. Refer to telindus1431Router/messages on page 576.
status	What indicate the status attributes of the Telindus 1431 SHDSL CPE? What is the status of the different interfaces (up, down, testing, …)? Refer to 15 - Status attributes on page 567.
performance	What indicate the performance attributes of the Telindus 1431 SHDSL CPE? What is the performance of the different interfaces (does the data pass the interface, is the interface up or down, when did it go up or down, …)? Refer to 16 - Performance attributes on page 685.
alarms	What indicate the alarm attributes of the Telindus 1431 SHDSL CPE? What is the alarm status of the different interfaces (link down, errors, …)? Refer to 17 - Alarm attributes on page 753.

6 Configuring Frame Relay to ATM interworking

This chapter introduces the Frame Relay to ATM interworking concepts FRF.5 and FRF.8. It also explains how to configure the Telindus 1431 SHDSL CPE for FRF.5 and FRF.8.

The following gives an overview of this chapter:

- 6.1 - Introducing Frame Relay to ATM interworking (FRF) on page 94
- 6.2 - Setting up FRF links on page 95
- 6.3 - Setting up FRF.5 links in one ATM PVC on page 99
- 6.4 - Transporting LMI over ATM in case of FRF.5 on page 101
- 6.5 - Configuring traffic mapping on page 103

Refer to the Reference manual on page 377 for a complete overview of the attributes of the Telindus 1431 SHDSL CPE.

6.1 Introducing Frame Relay to ATM interworking (FRF)

The Telindus 1431 SHDSL CPE supports two Frame Relay to ATM interworking functions:

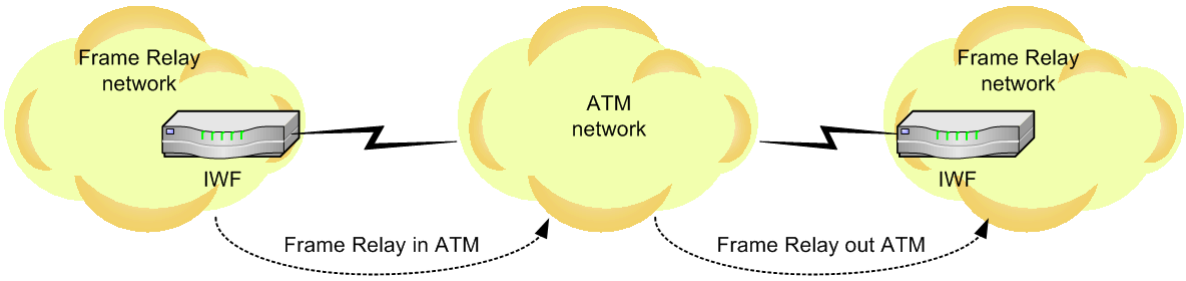
- the Frame Relay to ATM network interworking function (FRF.5).
- the Frame Relay to ATM service interworking function (FRF.8).

For detailed information on the two Frame Relay - ATM interworking functions FRF.5 and FRF.8, refer to the Frame Relay forum recommendations:

- Frame Relay/ATM PVC Network Interworking Implementation Agreement FRF.5
- Frame Relay/ATM PVC Service Interworking Implementation Agreement FRF.8.1

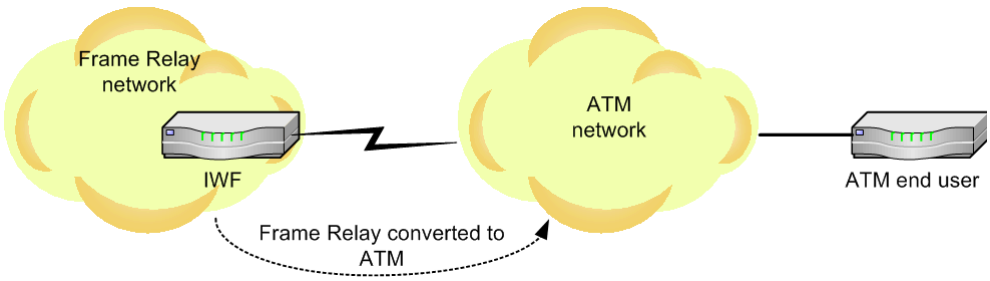
What is FRF.5?

The Frame Relay to ATM network interworking function allows the transparent tunnelling of Frame Relay user traffic and DLCIs over ATM. This function is often used to link Frame Relay networks over an ATM backbone. The most distant nodes must be configured to interoperate with one another, this in contrast to service interworking or FRF.8, because intact Frame Relay frames are sent over the ATM network. The ATM backbone is used as an alternative to a leased line, and provides cost savings over leased lines.



What is FRF.8?

The Frame Relay to ATM service interworking function allows communication between a Frame Relay end user and an ATM end user. The most distant nodes must not specifically be configured to interoperate with one another, this in contrast to network interworking or FRF.5, because Frame Relay frames are “converted” to ATM cells.

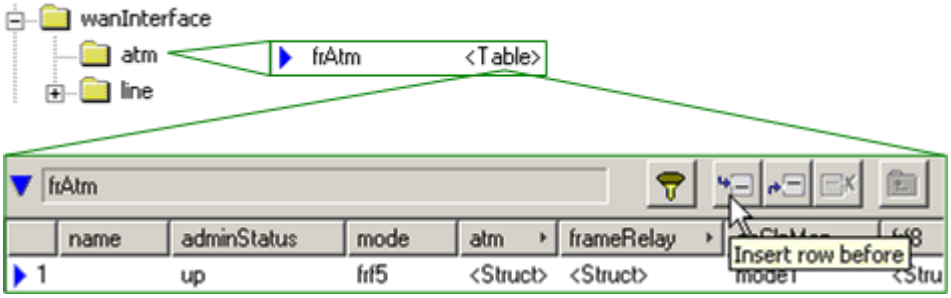


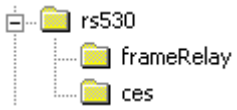
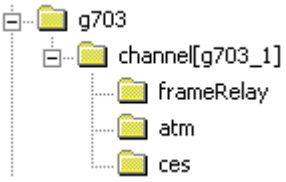
Note that according to the FRF.8 Agreement, the only higher layer protocols that can be transported are IP and Ethernet.

6.2 Setting up FRF links

Refer to 6.1 - Introducing Frame Relay to ATM interworking (FRF) on page 94 for an introduction on FRF.

In order to set up an FRF link, proceed as follows:

Step	Action
1	When setting up the Telindus 1431 SHDSL CPE for Frame Relay to ATM interworking (FRF), you have to set up … • DLCIs in the Frame Relay network on the one hand, • PVCs in the ATM network on the other hand. Instead of configuring the Frame Relay DLCIs in a DLCI table on the one hand and ATM PVCs in a PVC table on the other hand, one single table is created in which both the DLCIs and the PVCs have to be configured: the frAtm table. Also see Important remark on page 97. So go to the frAtm attribute and add one or more entries to this table.  Use this attribute to set up FRF links. Add a row to the frAtm table for each FRF link you want to create.

Step	Action
2	Configure the elements of the FRF link you just created. These elements are: • name. Use this element to assign an administrative name to the FRF link. • adminStatus. Use this element to activate or deactivate the FRF link. • mode. Use this element to select the function of the corresponding FRF link: FRF.5 (refer to What is FRF.5? on page 94) or FRF.8 (refer to What is FRF.8? on page 94). • atm. Use this element to configure the ATM related parameters of the FRF link (VPI, VCI, PCR, etc.). Refer to telindus1431Router/wanInterface/atm/frAtm on page 417 for more information on these parameters. • frameRelay. Use this element to configure the Frame Relay related parameters of the FRF link (DLCI, destination DLCI, CIR, EIR, etc.). Refer to telindus1431Router/wanInterface/atm/frAtm on page 417 for more information on these parameters. • deClpMap. Use this element to set the Frame Relay Discard Eligible (DE) to ATM Cell Loss Priority (CLP) mapping between a Frame Relay and an ATM network. Refer to 6.5 - Configuring traffic mapping on page 103 for more information. • frf8. Use this element to configure some specific FRF.8 parameters. Refer to telindus1431Router/wanInterface/atm/frAtm/frf8 on page 418 for more information on these parameters. Refer to … • telindus1431Router/wanInterface/atm/frAtm on page 417 for a detailed description of the frAtm table. • 9.1 - Configuring ATM encapsulation on page 128 for more information on ATM. • 9.2 - Configuring Frame Relay encapsulation on page 156 for more information on Frame Relay.
3	If you haven't already done so, insert a modular interface in the empty interface slot of the Telindus 1431 SHDSL CPE. Refer to 2.6 - Connecting the Telindus 1431 SHDSL CPE on page 18 for more information on how to do so.  ⇒A corresponding interface object appears in the containment tree. Depending on which type of modular interface is used, the name of the modular interface object (labelled <modularIf> in the following text) can be g703/channel[g703_1], rs530, v35, v36 or x21. 

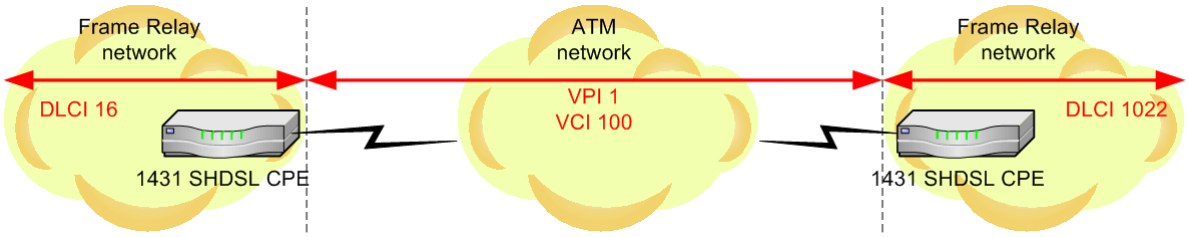
Step	Action
4	Configure the modular interface. **Serial modular interface** If you inserted a serial modular interface, then the most important attributes that you have to configure are: • telindus1431Router/<modularIf>/encapsulation on page 457. In case of FRF, you have to set this attribute to frameRelay. • telindus1431Router/<modularIf>/frameRelay/syncSettings on page 432. Use the elements in this structure to set the clocking and the speed. **G703 modular interface** If you inserted a G703 modular interface, then the most important attributes that you have to configure are: • telindus1431Router/g703/coding on page 459. Use this attribute to set the G703 interface encoding mode: AMI or HDB3. • telindus1431Router/g703/framing on page 459. Use this attribute to select between unframed (transparent) mode or framed (fractional E1) mode. • telindus1431Router/g703/clocking on page 460. Use this attribute to select a clocking mode. • telindus1431Router/g703/channel[ ]/timeSlots on page 465. If you set the framing attribute to framed, then use the timeSlots attribute to enable or disable the individual 64 kbps time slots in the framed data stream. • telindus1431Router/<modularIf>/encapsulation on page 457. In case of FRF, you have to set this attribute to frameRelay.
5	If desired, you can fine-tune the Frame Relay related parameters of the modular interface. Do this using the attribute telindus1431Router/<modularIf>/frameRelay/lmi on page 429.

Important remark

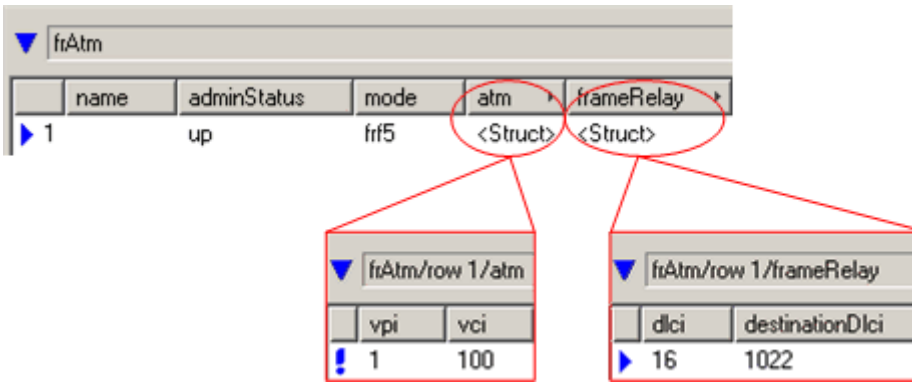
- As mentioned above, in case of FRF you configure both the DLCIs and the PVCs in the frAtm table. *So do not use the pvcTable in the atm object to configure the PVCs in case of FRF!*
- Note however, that if you want to create ATM PVCs for routing and/or bridging the LAN data, then you have to create them in the pvcTable. Make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the frAtm table and vice versa.
- The status and performance information of the DLCIs and PVCs you created in the configuration frAtm table can be found in …
  - the status frAtm table. Refer to telindus1431Router/wanInterface/atm/frAtm on page 596.
  - the status dlciTable. Refer to telindus1431Router/<modularIf>/frameRelay/dlciTable on page 598.
  - the performance dlciTable. Refer to telindus1431Router/<modularIf>/frameRelay/dlciTable on page 707.
  - the status pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 591.
  - the performance pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 702.

Example

The following figure gives an example of two Telindus 1431 SHDSL CPEs, both situated in a Frame Relay network and communicating with each other over an ATM network (i.e. FRF.5).



The following screenshot shows (part of) the frAtm table of the set-up depicted in the figure above:



6.3 Setting up FRF.5 links in one ATM PVC

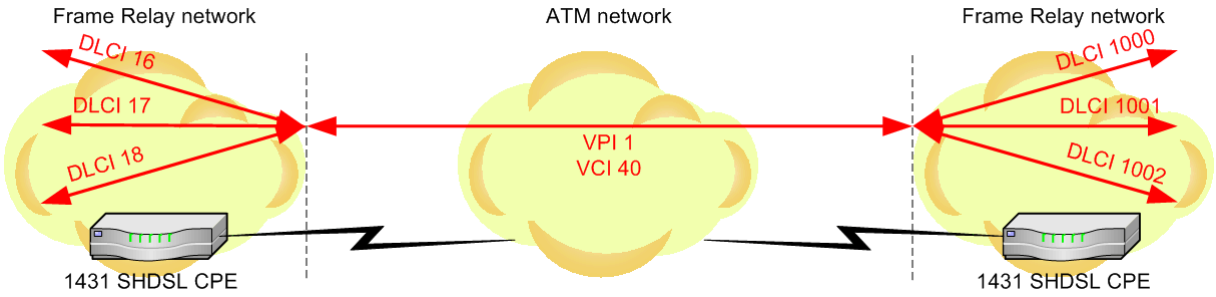
Refer to 6.1 - Introducing Frame Relay to ATM interworking (FRF) on page 94 for an introduction on FRF.

In case of FRF.5, intact Frame Relay frames are sent over an ATM network. Because these frames are completely intact, frames from different DLCIs are always distinguishable from one another. So when you transport multiple DLCIs over the ATM network, you can put them in one ATM PVC.

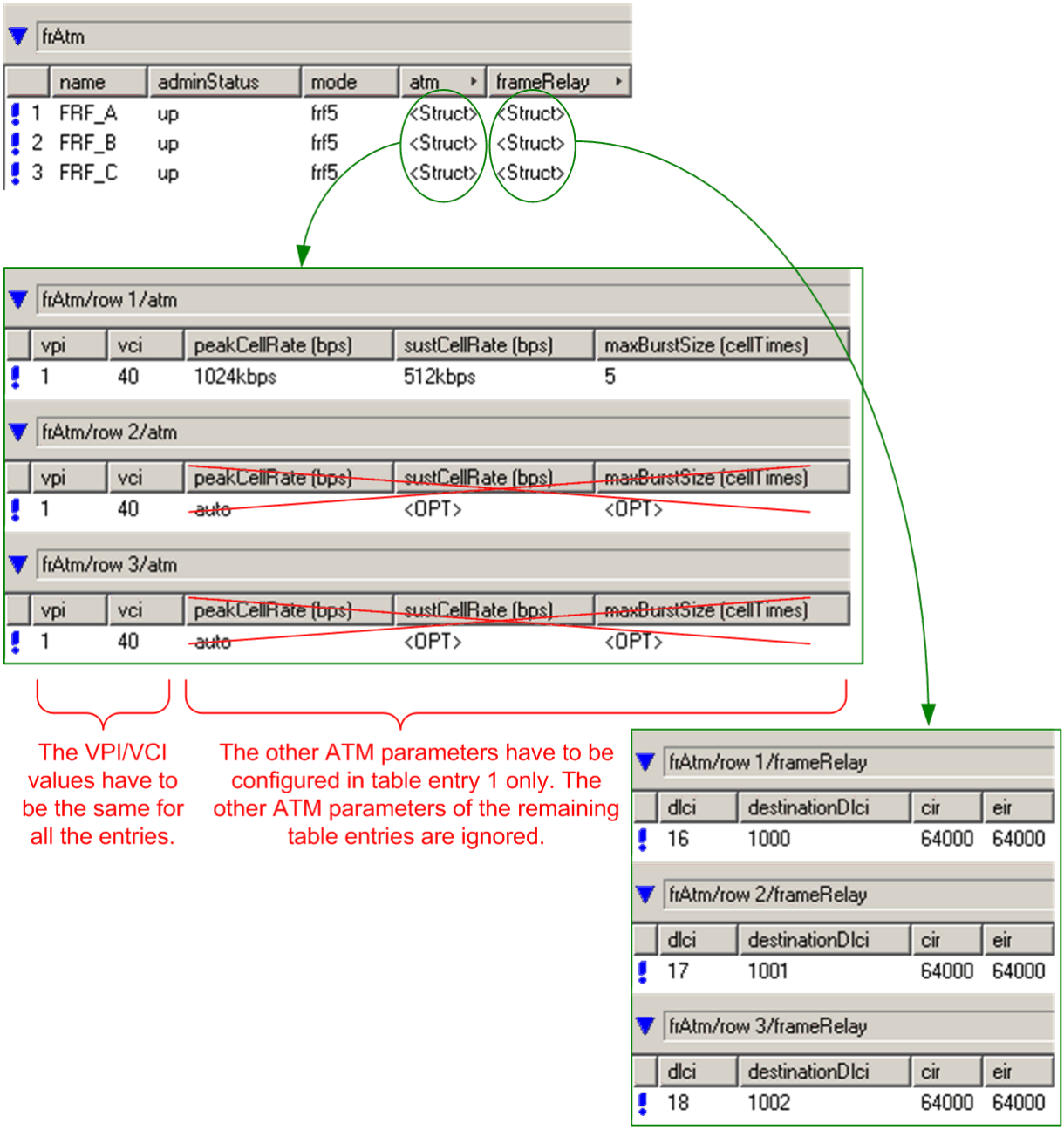
Do this by creating multiple entries in the frAtm table and by setting the VPIs/VCIs of all entries to the same values. The following example tries to explain this.

Example

Suppose you have two Telindus 1431 SHDSL CPEs, both situated in a Frame Relay network and communicating with each other over an ATM network (i.e. FRF.5). You want to transport 3 DLCIs from one Frame Relay network to the other Frame Relay network. You want to put the 3 Frame Relay DLCIs in 1 ATM PVC.



Configure this setup as follows:



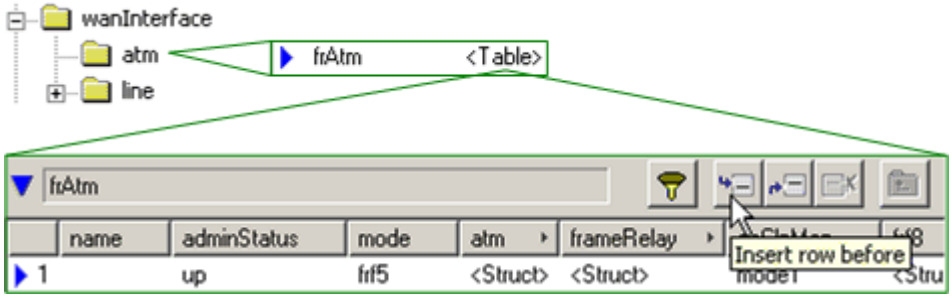
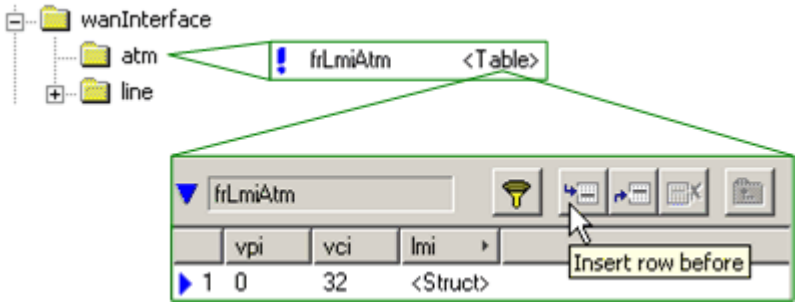
Note that in order to put all the DLCIs in one ATM PVC, you have to set the VPI/VCIs of all the frAtm table entries to the same value. However, the other ATM parameters (e.g. PCR, SCR, MBS, etc.) have to be configured in table entry 1 only. The other ATM parameters of all remaining table entries are ignored.

6.4 Transporting LMI over ATM in case of FRF.5

Refer to 6.1 - Introducing Frame Relay to ATM interworking (FRF) on page 94 for an introduction on FRF.

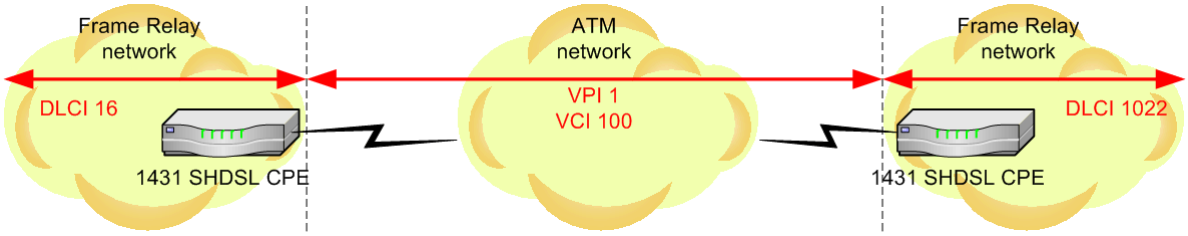
In case of FRF.5, two Frame Relay networks are connected to each other over an ATM network. Since you can run LMI in the Frame Relay networks, you probably want that LMI can be transported form the one Frame Relay network to the other Frame Relay network. Do this using the frLmiAtm table.

To transport LMI over ATM in case of FRF.5, proceed as follows:

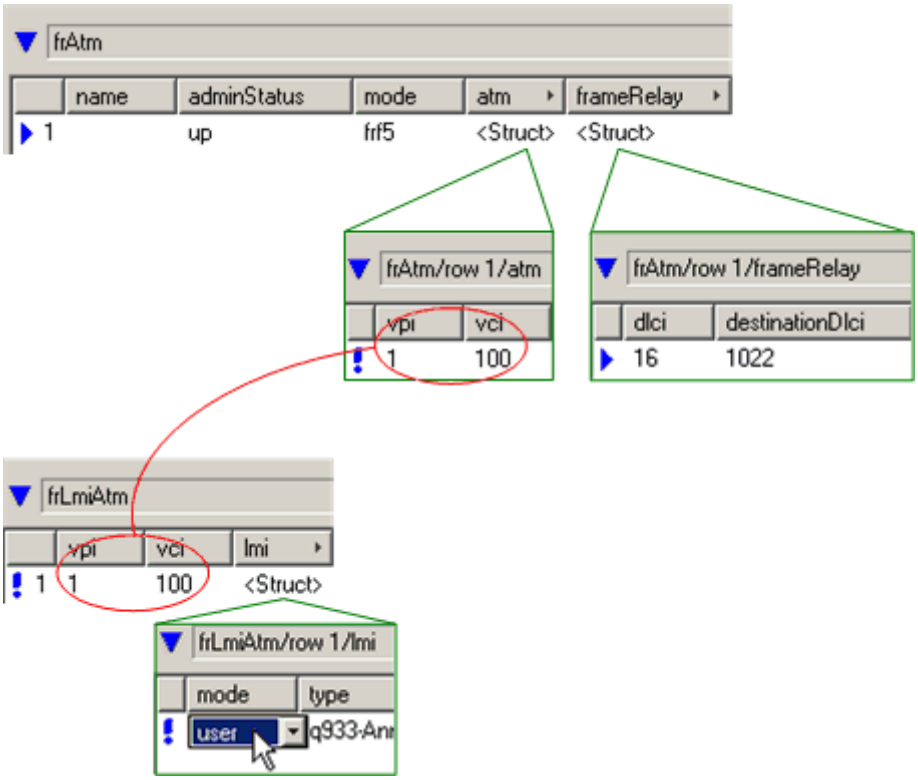
Step	Action
1	First configure FRF.5 links in the frAtm table as explained in 6.2 - Setting up FRF links on page 95. 
2	Go to the frLmiAtm table and add an entry for every FRF.5 link for which you want to enable LMI. 
3	Configure the elements in the frLmiAtm table: • vpi and vci. In order to enable LMI on a particular FRF.5 link, you have to set the vpi and vci elements in the frLmiAtm table to the same values as the vpi and vci elements in the frAtm table for that particular FRF.5 link. • lmi. Use this structure to enable, disable and fine-tune LMI. Refer to telindus1431Router/wanInterface/atm/frLmiAtm on page 419 for a detailed description of the frLmiAtm table.

Example

Suppose you have two Telindus 1431 SHDSL CPEs, both situated in a Frame Relay network and communicating with each other over an ATM network (i.e. FRF.5). You want to transport a DLCI from one Frame Relay network to the other Frame Relay network and enable LMI.



Configure this setup as follows:



6.5 Configuring traffic mapping

This section explains how to configure the traffic mapping between a Frame Relay and ATM network. First it introduces the traffic mapping concept. Then it describes how to configure the Discard Eligible (DE) and Cell Loss Priority (CLP) mapping followed by the Forward Explicit Congestion Notification (FECN) / Backward Explicit Congestion Notification (BECN) and Explicit Forward Congestion Indication (EFCI) mapping. Finally, it explains the FRF.8 upper layer user protocol encapsulation.

The following gives an overview of this section:

- 6.5.1 - Introducing traffic mapping on page 104
- 6.5.2 - Configuring the DE / CLP mapping on page 105
- 6.5.3 - Configuring congestion indication mapping on page 110
- 6.5.4 - Configuring FRF.8 upper layer user protocol encapsulation on page 115

6.5.1 Introducing traffic mapping

What is traffic mapping?

The main task of the InterWorking Function (IWF) is to map Frame Relay frames to and from the ATM transport service. This mapping is done in a simple manner. Some of the Frame Relay frame content, such as the CRC-16, is not needed and simply stripped off (the Frame Relay CRC is redundant because AAL5 protects its PDU with the AAL5 CRC). The mapping of Frame Relay to AAL5 CPCS is performed by a sub-layer known as the Frame Relay Service Specific Convergence Sub-layer (FR-SSCS). The FR-SSCS is mapped into the AAL5 CPCS PDU and then segmented using the normal AAL5 procedures.

What is DE / CLP mapping?

Frame Relay and ATM both have traffic policing mechanisms to handle traffic that doesn't meet the committed traffic transfer rate contract. ATM its separation of non-conforming cells is called the Generic Cell Rate Algorithm (GCRA). ATM tags cells that exceed the allowed traffic limit by setting the CLP. Frame Relay has a similar mechanism based on the Committed Information Rate algorithm (CIR) which results in setting the DE bit in the frame header. Marked cells or frames may still traverse the network, but when congestion is experienced, this is the first traffic to be discarded.

DE / CLP mapping modes

Interworking units must both preserve the discard priority information and maintain the efficiency of the destination network by accurately simulating its behaviour. There are two mapping modes to do so:

DE / CLP mapping mode	Description
mode 1	This mode applies to both FRF.5 and FRF.8. In this mode the Frame Relay DE bits are mapped into the Cell Loss Priority (CLP). By doing so, cells containing tagged Frame Relay frames will be discarded first if congestion occurs. As a result, the overall throughput of high priority frames will increase.
mode 2	In case of … • FRF.5, in this mode the Frame Relay DE bit is copied to, or from, the FR-SSCS frame. By doing so, the discard priority information is simply retained. • FRF.8, in this mode the Frame Relay DE bit and ATM CLP are set to a constant, configurable, value.

What is congestion indication mapping?

Both Frame Relay and ATM support a mechanism to indicate congestion to network devices. While Frame Relay supports congestion indication in both forward and backward directions (FECN and BECN bits), ATM only supports forward congestion (EFCI field).

6.5.2 Configuring the DE / CLP mapping

Refer to 6.5.1 - Introducing traffic mapping on page 104 for an introduction on traffic mapping in general.

You can configure the DE / CLP mapping using the deClpMap element in the frAtm table (refer to telindus1431Router/wanInterface/atm/frAtm on page 417). The following paragraphs explain the mapping modes more detailed and this for both directions (i.e. from Frame Relay to ATM and vice versa). An overview of these paragraphs is given below:

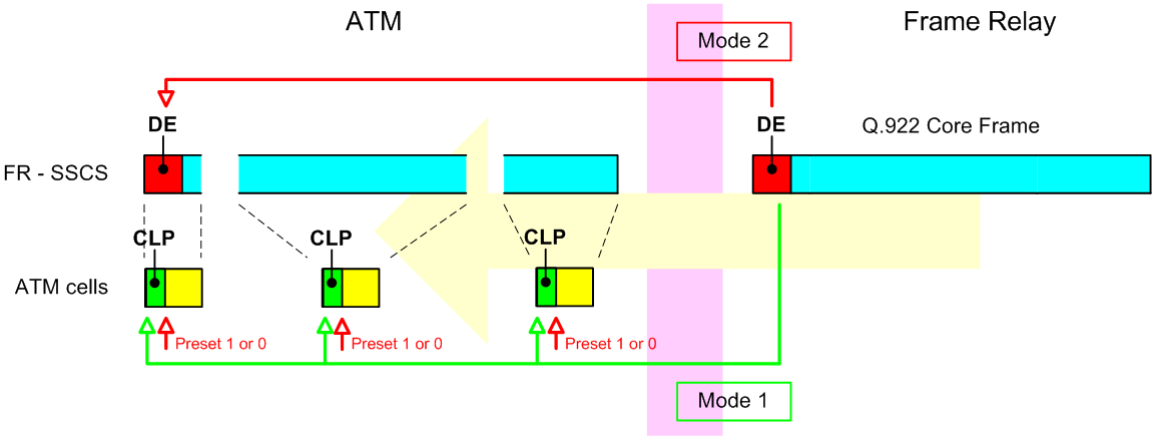
	Frame Relay → ATM	**ATM → Frame Relay**
FRF.5	FRF.5 - DE/CLP mapping - Frame Relay to ATM on page 106	FRF.5 - DE/CLP mapping - ATM to Frame Relay on page 107
FRF.8	FRF.8 - DE/CLP mapping - Frame Relay to ATM on page 108	FRF.8 - DE/CLP mapping - ATM to Frame Relay on page 109

FRF.5 - DE/CLP mapping - Frame Relay to ATM

Use the deClpMap element in the frAtm table to set the DE / CLP mapping mode.

The deClpMap element has the following values:

Value	Description
mode1	The Discard Eligibility (DE) field in the Q.922 core frame is … • copied unchanged into the DE field in the FR-SSCS PDU header. • mapped to the ATM Cell Loss Priority (CLP) of every ATM cell generated by the segmentation process of that frame.
mode2 de/clp 0	• The DE field in the Q.922 core frame is copied unchanged into the DE field in the FR-SSCS PDU header. • The ATM Cell Loss Priority of every ATM cell generated by the segmentation process of that frame is set to the constant value 0.
mode2 de/clp 1	• The DE field in the Q.922 core frame is copied unchanged into the DE field in the FR-SSCS PDU header. • The ATM Cell Loss Priority of every ATM cell generated by the segmentation process of that frame is set to the constant value 1.

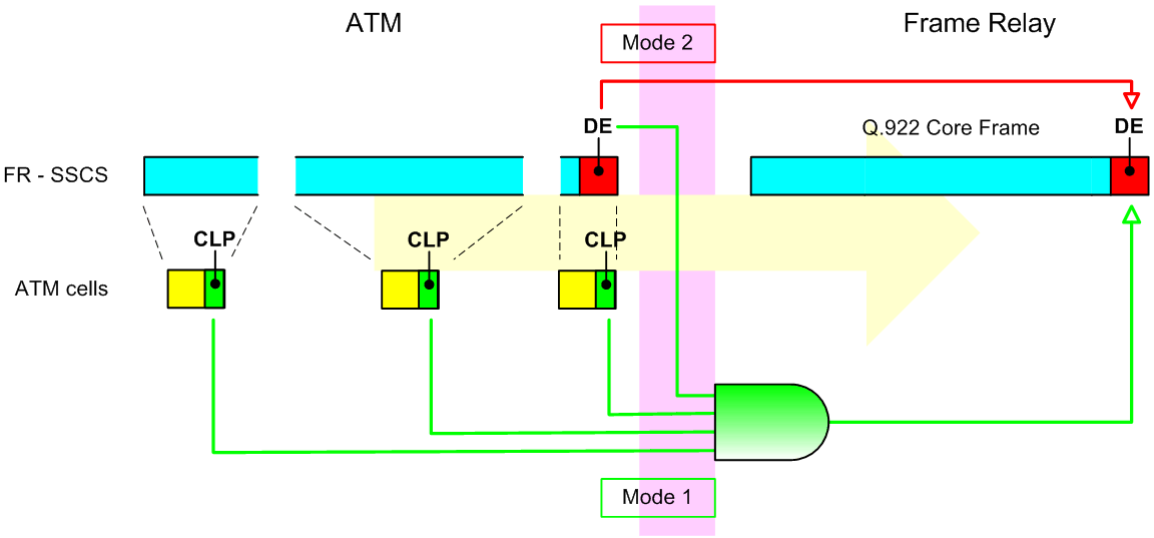


FRF.5 - DE/CLP mapping - ATM to Frame Relay

Use the deClpMap element in the frAtm table to set the DE / CLP mapping mode.

The deClpMap element has the following values:

Value	Description
mode1	• If one or more ATM cells belonging to a frame has its CLP field set to 1, or • if the DE field of the FR-SSCS PDU is set to 1, … then the DE field of the Q.922 core frame is set to 1.
mode2 de/clp 0	No mapping is performed from the ATM layer to Q.922 core layer. The FR-SSCS PDU DE field is copied unchanged to the Q.922 core frame DE field, independent of CLP indications(s) received at the ATM layer.
mode2 de/clp 1	

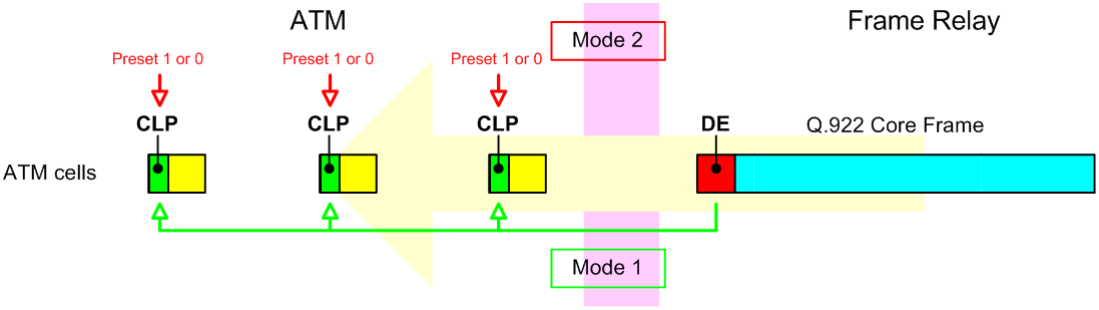


FRF.8 - DE/CLP mapping - Frame Relay to ATM

Use the deClpMap element in the frAtm table to set the DE / CLP mapping mode.

The deClpMap element has the following values:

Value	Description
mode1	The DE field in the Q.922 core frame is mapped to the ATM CLP field of every cell generated by the segmentation process of the AAL5 PDU containing the information of that frame.
mode2 de/clp 0	The ATM CLP of every ATM cell generated by the segmentation process of the AAL5 PDU containing the information of that frame shall be set to the constant value 0.
mode2 de/clp 1	The ATM CLP of every ATM cell generated by the segmentation process of the AAL5 PDU containing the information of that frame shall be set to the constant value 1.

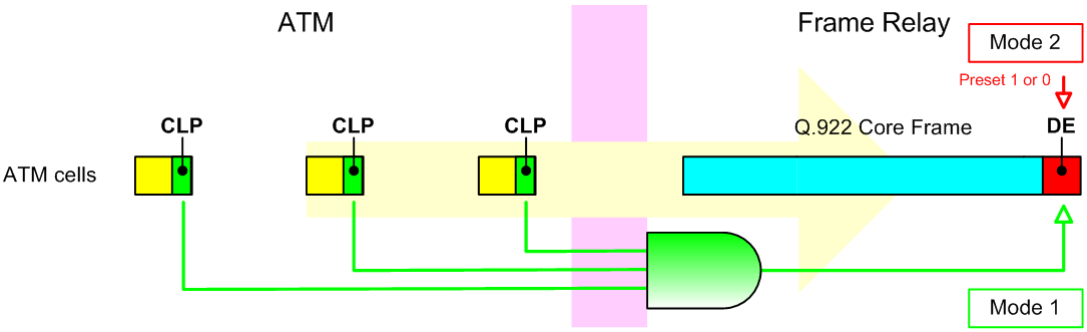


FRF.8 - DE/CLP mapping - ATM to Frame Relay

Use the deClpMap element in the frAtm table to set the DE / CLP mapping mode.

The deClpMap element has the following values:

Value	Description
mode1	If one or more cells belonging to a frame has its CLP field set to 1, then the DE field of the Q.922 Core frame is set to 1.
mode2 de/clp 0	The DE field of the Q.922 Core frame is set to the constant value 0.
mode2 de/clp 1	The DE field of the Q.922 Core frame is set to the constant value 1.



6.5.3 Configuring congestion indication mapping

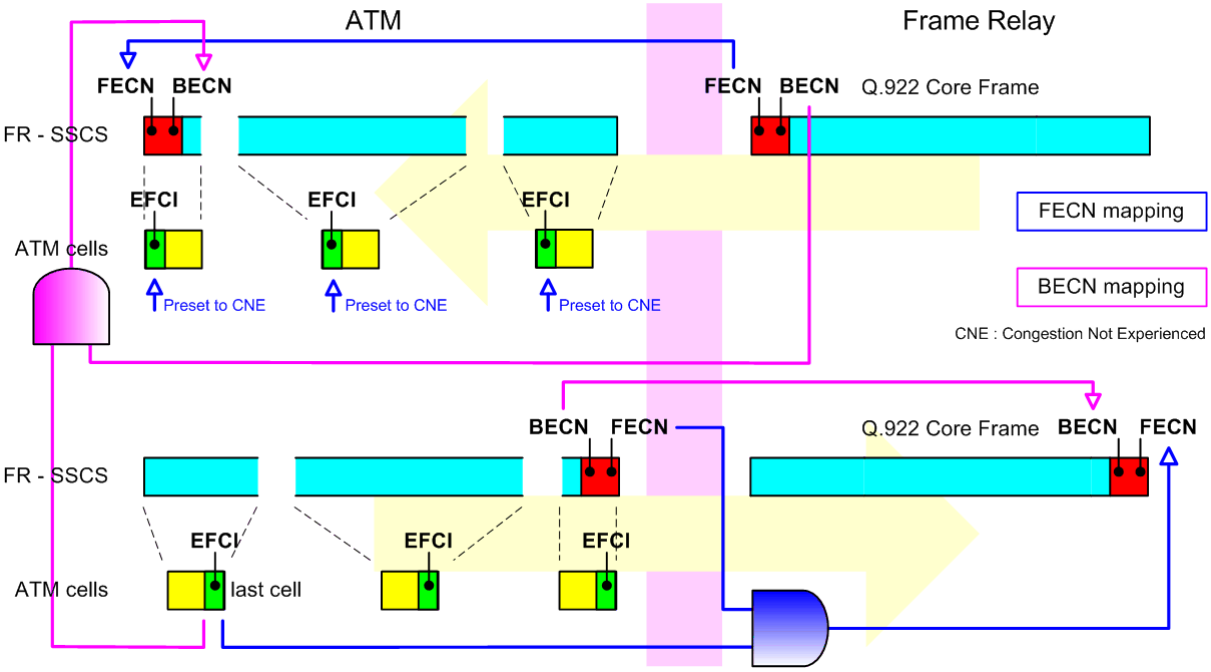
Refer to 6.5.1 - Introducing traffic mapping on page 104 for an introduction on traffic mapping in general.

Using the congestionMap element in the frf8 structure of the frAtm table (refer to telindus1431Router/wanInterface/atm/frAtm on page 417) you can actually only configure the FECN / EFCI mapping when going from Frame Relay to ATM in case of FRF.8. In all other cases, the mapping occurs following a fixed scheme.

The following paragraphs explain the mapping modes more detailed and this for both directions (i.e. from Frame Relay to ATM and vice versa). An overview of these paragraphs is given below:

	Frame Relay → ATM		**ATM → Frame Relay**	
	FECN / EFCI	**BECN / EFCI**	**FECN / EFCI**	**BECN / EFCI**
FRF.5	FRF.5 - FECN/EFCI mapping - Frame Relay to ATM on page 112	FRF.5 - BECN/EFCI mapping - Frame Relay to ATM on page 112	FRF.5 - FECN/EFCI mapping - ATM to Frame Relay on page 112	FRF.5 - BECN/EFCI mapping - ATM to Frame Relay on page 112
FRF.8	FRF.8 - FECN/EFCI mapping - Frame Relay to ATM on page 114	FRF.8 - BECN/EFCI mapping - Frame Relay to ATM on page 114	FRF.8 - FECN/EFCI mapping - ATM to Frame Relay on page 114	FRF.8 - BECN/EFCI mapping - ATM to Frame Relay on page 114

FRF.5 - FECN and BECN / EFCI mapping overview



Also see the FRF.5 - FECN and BECN / EFCI mapping overview on page 111.

FRF.5 - FECN/EFCI mapping - Frame Relay to ATM

Frame level FECN is not mapped to cell level EFCI.

- The FECN field of the Q.922 core Frame is copied unchanged into the FECN field in the FR-SSCS PDU.
- The EFCI field of all ATM cells is always set to “congestion not experienced”.

FRF.5 - FECN/EFCI mapping - ATM to Frame Relay

Cell level EFCI is mapped to frame level FECN.

- If the EFCI field in the last ATM cell of a segmented frame received is set to “congestion experienced”,

or

- if the FECN field of the received FR-SSCS PDU is set to “congestion experienced”,

… then the FECN of the Q.922 core frame is set to “congestion experienced”.

FRF.5 - BECN/EFCI mapping - Frame Relay to ATM

Backward congestion indication is supported only at the frame level by the Backward Explicit Congestion Notification (BECN) field.

The BECN field in the FR-SSCS PDU is set to “congestion experienced” if …

- BECN is set in the Q.922 core frame relayed in the Frame Relay to ATM direction,

or

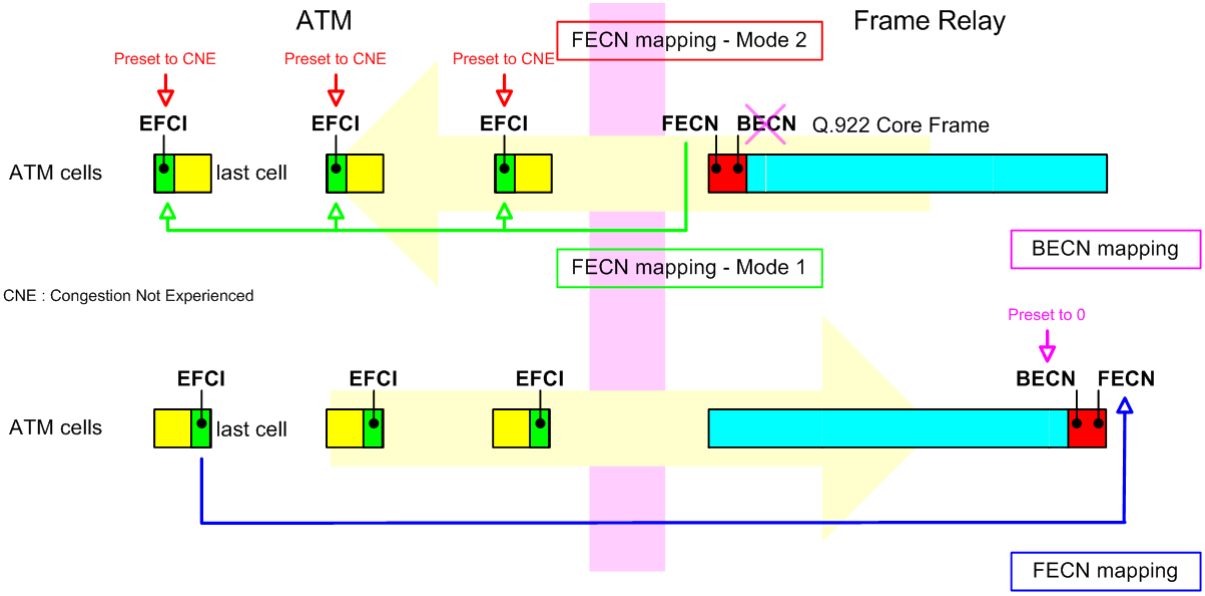
- EFCI was set to “congestion experienced” in the last ATM cell of the last segmented frame received in the ATM to Frame Relay direction for this bi-directional connection (i.e., EFCI set to “congestion experienced” due to FECN mapping in the ATM to Frame Relay direction).

FRF.5 - BECN/EFCI mapping - ATM to Frame Relay

Backward congestion indication is supported only at the frame level by the Backward Explicit Congestion Notification (BECN) field.

The BECN field in the FR-SSCS PDU is copied unchanged into the BECN field of the Q.922 core frame.

FRF.8 - FECN and BECN / EFCI mapping overview



Also see the FRF.8 - FECN and BECN / EFCI mapping overview on page 113.

FRF.8 - FECN/EFCI mapping - Frame Relay to ATM

Using the congestionMap element in the frf8 structure of the frAtm table you can actually only configure the FECN / EFCI mapping when going from Frame Relay to ATM in case of FRF.8.

The congestionMap element has the following values:

Value	Description
mode1	The FECN field in the Q.922 core frame is mapped to the ATM EFCI field of every cell generated by the segmentation process of the AAL5 PDU containing the information of that frame. This mode provides congestion indication to the end-points where higher level protocol entities might be involved in traffic control mechanisms. This mode may not be desirable with future reactive congestion control mechanisms of ATM networks.
mode2	The FECN field in the Q.922 core frame is not mapped to the ATM EFCI field of cells generated by the segmentation process of the AAL5 PDU containing the information of that frame. The EFCI field is always set to “congestion not experienced”.

In both of the modes above, if there is congestion in the forward direction in the ATM layer within the IWF, then the IWF can set the EFCI field to “congestion experienced”.

FRF.8 - FECN/EFCI mapping - ATM to Frame Relay

If the EFCI field in the last cell of a segmented frame received is set to “congestion experienced”, then the FECN of the Q.922 Core frame is set to “congestion experienced”.

FRF.8 - BECN/EFCI mapping - Frame Relay to ATM

The BECN of the received Q.922 Core frame is ignored.

FRF.8 - BECN/EFCI mapping - ATM to Frame Relay

The BECN of the Q.922 Core frame is set to 0.

6.5.4 Configuring FRF.8 upper layer user protocol encapsulation

Refer to 6.5.1 - Introducing traffic mapping on page 104 for an introduction on traffic mapping in general.

Using the mode element in the frf8 structure of the frAtm table (refer to telindus1431Router/wanInterface/atm/frAtm on page 417) you can configure the upper layer user protocol encapsulation for each pair of interoperable Frame Relay DLCI and ATM PVC.

The mode element has the following values:

Value	Description
transparent	The upper layer user protocol encapsulations are forwarded unaltered. No mapping nor fragmentation/reassembly is performed. Use this mode when the encapsulation methods do not conform to the standards cited in translation mode but they are compatible between terminal equipment (e.g., packetised voice).
translation	The upper layer user protocol encapsulations are mapped between the Frame Relay and ATM network. Translation mode supports the interworking of internetworking (routed and/or bridged) protocols. Use this mode for the encapsulation methods for carrying multiple upper layer user protocols (e.g., LAN to LAN) over a Frame Relay PVC and an ATM PVC conform to the standard FRF.3.2 and RFC 2684 respectively.

Encapsulation mapping in translation mode

Routed or bridged PDUs transferred over Frame Relay DLCIs are encapsulated according to the NLPID method described in FRF.3.2. For ATM AAL5 PVCs, PDUs are encapsulated according to the LLC method as defined in RFC 2684.

Mapping between encapsulated ATM PDUs and encapsulated Frame Relay PDUs requires the examination of the incoming ATM AAL5 CPCS-PDU payload header or Frame Relay Q.922 PDU payload header to determine the type, and then overwriting the incoming header with the outgoing header.

The VC-based Multiplexing method described in RFC 2684 is not supported.

Refer to the Frame Relay forum recommendation FRF.8 for more detailed information.

7 Configuring Circuit Emulation Service

This chapter introduces the Circuit Emulation Service (CES) concept. It also explains how to configure the Telindus 1431 SHDSL CPE for CES.

The following gives an overview of this chapter:

- 7.1 - Introducing Circuit Emulation Service (CES) on page 118
- 7.2 - Setting up CES links on page 119

Refer to the Reference manual on page 377 for a complete overview of the attributes of the Telindus 1431 SHDSL CPE.

7.1 Introducing Circuit Emulation Service (CES)

What is CES?

The Circuit Emulation Service (CES) simply provides a transparent transport mechanism for TDM networks over an ATM network. CES provides an ideal stepping-stone from legacy TDM networks to full ATM-enabled broadband solutions.

CES uses the ATM AAL1 adaption mechanism to segment the incoming traffic into ATM cells with the necessary timing information to ensure that the circuit can be correctly reassembled at the destination.

What is synchronous versus asynchronous CES?

- Synchronous CES assumes that synchronized clocks are available on each end. Therefore, no clocking information is transported in the ATM cell.
- Asynchronous CES sends clocking information in ATM cells to the remote end of the circuit. Clocking information sent in the ATM cell is called Synchronous Residual Time Stamp (SRTS).

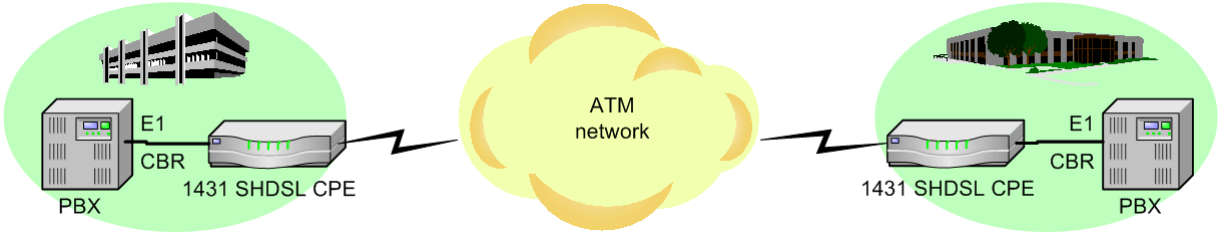
The Telindus 1431 SHDSL CPE supports synchronous CES only.

What is structured versus unstructured CES?

- Unstructured CES (also called “clear channel”) utilises the entire E1 bandwidth, meaning there is only one single channel. The Telindus 1431 SHDSL CPE simply reproduces a stream of bits with clocking from the receiving port to the target port.
- Structured CES (also called “channelised E1”) is designed to emulate point-to-point fractional E1 (Nx64k) connections. This allows the E1 to break into multiple channels towards different destinations. More than one circuit (AAL1) entity shares the same physical E1 interface.

Typical application

A typical application of CES is the extension of a private telephone network across multiple campuses, as illustrated below. For example, there are two campuses with a private branch exchange (PBX) on each. You can use an ATM network to connect the PBXs without having ATM capabilities on the PBX itself. By doing so, voice traffic between two campuses uses your private ATM backbone instead of leased lines, thereby using the same ATM network for your voice and data needs.

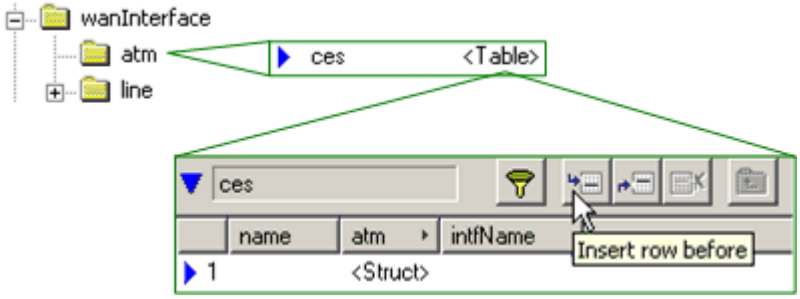


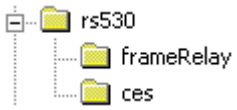
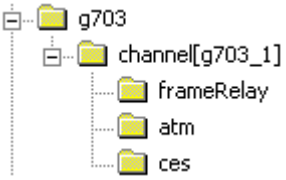
So in other words, the job of the two CES InterWorking Functions (IWF, in this case the two Telindus 1431 SHDSL CPEs) is to extend the Constant Bit-Rate (CBR) circuit to which they are connected across the ATM network. They are to do this in a manner that is transparent to the terminating equipment of the CBR circuit.

7.2 Setting up CES links

Refer to 7.1 - Introducing Circuit Emulation Service (CES) on page 118 for an introduction on CES.

In order to set up a CES link, proceed as follows:

Step	Action
1	When setting up the Telindus 1431 SHDSL CPE for the Circuit Emulation Service (CES), you have to … • set up PVCs in the ATM network over which you want to transport the TDM traffic. • specify the interface to which the TDM network is connected. In case of a G703 interface, this can also be a logical channel. You can do this in the ces table. Also see Important remark on page 121. So go to the ces attribute and add one or more entries to this table.  Use this attribute to set up CES links. Add a row to the ces table for each CES link you want to create.
2	Configure the elements of the CES link you just created. These elements are: • name. Use this element to assign an administrative name to the CES link. • adminStatus. Use this element to activate or deactivate the CES link. • atm. Use this element to configure the ATM related parameters of the CES link (VPI, VCI, etc.). Refer to telindus1431Router/wanInterface/atm/ces on page 420 for more information on these parameters. • intfName. Use this element to enter the name of the interface on which the CES link has to be set up. In case of a … - serial modular interface, enter the value of the name attribute (refer to telindus1431Router/<serialIf>/name on page 467). By default, the name corresponds with the type of serial interface that is used, being: rs530, v35, v36 and x21. - G703 modular interface, enter the index name of the channel object. So for the channel[g703_1] object, which is present by default, you enter g703_1. Refer to … • telindus1431Router/wanInterface/atm/ces on page 420 for a detailed description of the ces table. • 9.1 - Configuring ATM encapsulation on page 128 for more information on ATM. • 9.3 - Configuring CES encapsulation on page 164 for more information on CES.

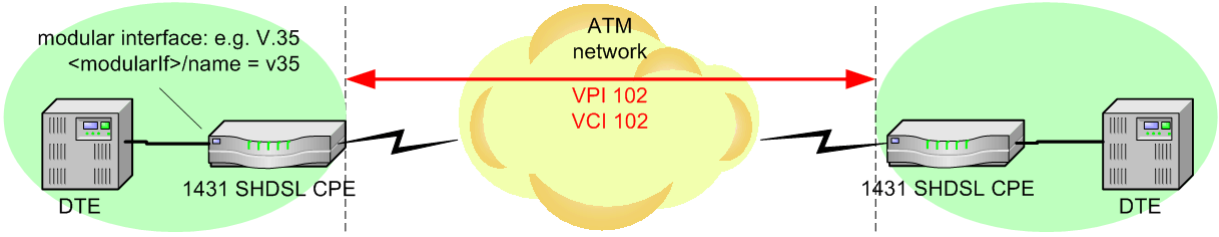
Step	Action
3	If you haven't already done so, insert a modular interface in the empty interface slot of the Telindus 1431 SHDSL CPE. Refer to 2.6 - Connecting the Telindus 1431 SHDSL CPE on page 18 for more information on how to do so.  ⇒A corresponding interface object appears in the containment tree. Depending on which type of modular interface is used, the name of the modular interface object (labelled <modularIf> in the following text) can be g703/channel[g703_1], rs530, v35, v36 or x21. 
4	Configure the modular interface. **Serial modular interface** If you inserted a serial modular interface, then the most important attributes that you have to configure are: • telindus1431Router/<modularIf>/encapsulation on page 457. In case of CES, you have to set this attribute to ces. • telindus1431Router/<modularIf>/ces/syncSettings on page 437. Use the elements in this structure to set the clocking and the speed. **G703 modular interface** If you inserted a G703 modular interface, then the most important attributes that you have to configure are: • telindus1431Router/g703/coding on page 459. Use this attribute to set the G703 interface encoding mode: AMI or HDB3. • telindus1431Router/g703/framing on page 459. Use this attribute to select between unframed (transparent) mode or framed (fractional E1) mode. • telindus1431Router/g703/clocking on page 460. Use this attribute to select a clocking mode. • telindus1431Router/g703/channel[ ]/timeSlots on page 465. If you set the framing attribute to framed, then use the timeSlots attribute to enable or disable the individual 64 kbps time slots in the framed data stream. • telindus1431Router/<modularIf>/encapsulation on page 457. In case of CES, you have to set this attribute to ces.
5	If desired, you can fine-tune the CES related parameters of the modular interface. Do this using the attributes described in 14.5.3 - CES configuration attributes on page 434.

Important remark

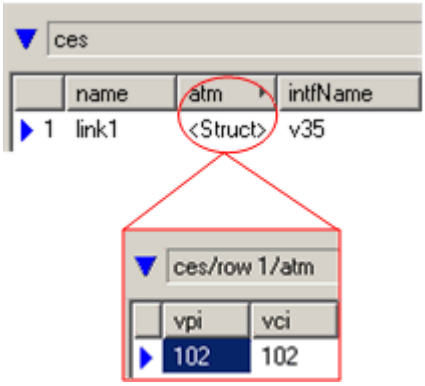
- As mentioned above, in case of CES you configure the PVCs in the ces table. *So do not use the pvcTable in the atm object to configure the PVCs in case of CES!*
- Note however, that if you want to create ATM PVCs for routing and/or bridging the LAN data, then you have to create them in the pvcTable. Make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the ces table and vice versa.
- The status and performance information of the PVCs you created in the configuration ces table can be found in …
  - the status pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 591.
  - the performance pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 702.

Example

The following figure gives an example of two Telindus 1431 SHDSL CPEs, connected to each other over an ATM network and using CES to connect the DTEs:



The following screenshot shows the ces table of the set-up depicted in the figure above:



8 Configuring ATM switching

This chapter introduces the ATM switching concept. It also explains how to configure the Telindus 1431 SHDSL CPE for ATM switching.

The following gives an overview of this chapter:

- 8.1 - Introducing ATM switching on page 124
- 8.2 - Setting up ATM switch links on page 125

Refer to the Reference manual on page 377 for a complete overview of the attributes of the Telindus 1431 SHDSL CPE.

8.1 Introducing ATM switching

What is ATM switching?

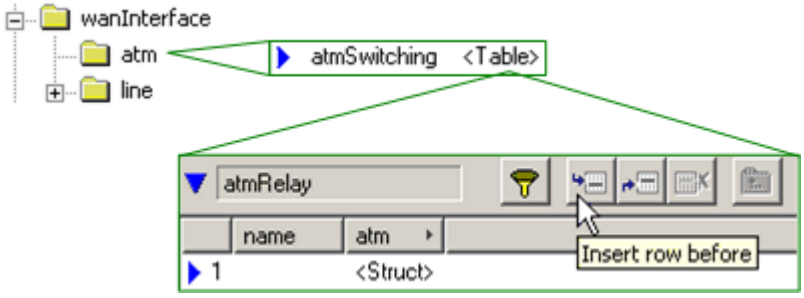
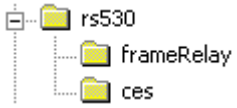
The ATM switching mode on the Telindus 1431 SHDSL CPE should be seen as a media conversion between E1 and SHDSL. Data is transferred in both directions with almost no delay (provided there is enough bandwidth available). No additional issues are considered. Therefore, the atmSwitching table only contains the elements VPI and VCI and nothing else (no QoS parameters etc.). So in other words, the ATM data is moved transparently from the E1 to the SHDSL line and vice versa.

The ATM over E1 feature of the Telindus 1431 SHDSL CPE complies with ITU-T G.804.

8.2 Setting up ATM switch links

Refer to 8.1 - Introducing ATM switching on page 124 for an introduction on ATM switching.

In order to set up an ATM switch link, proceed as follows:

Step	Action
1	Go to the atmSwitching attribute and add one or more entries to this table.  Use this attribute to set up ATM switching links. Add a row to the atmSwitching table for each ATM switching link you want to create.
2	Configure the elements of the ATM switching link you just created. These elements are: • name. Use this element to assign an administrative name to the ATM switching link. • atm. Use this element to configure the VPI and VCI of the ATM PVC you want to switch. The ATM switching mode on the Telindus 1431 SHDSL CPE should be seen as a media conversion between E1 and SHDSL. Data is transferred in both directions with almost no delay (provided there is enough bandwidth available). No additional issues are considered. Therefore, the atmSwitching table only contains the elements VPI and VCI and nothing else (no QoS parameters etc.). So in other words, the ATM data is moved transparently from the E1 to the SHDSL line and vice versa. Refer to telindus1431Router/wanInterface/atm/atmSwitching on page 423 for a detailed description of the atmSwitching table.
3	If you haven't already done so, insert a modular interface in the empty interface slot of the Telindus 1431 SHDSL CPE. Refer to 2.6 - Connecting the Telindus 1431 SHDSL CPE on page 18 for more information on how to do so.  ⇒A corresponding interface object appears in the containment tree. Depending on which type of modular interface is used, the name of the modular interface object (labelled <modularIf> in the following text) can be g703/channel[g703_1], rs530, v35, v36 or x21.

Step	Action
4	Configure the modular interface. **Serial modular interface** If you inserted a serial modular interface, then the most important attributes that you have to configure are: • telindus1431Router/<modularIf>/encapsulation on page 457. In case of ATM switching, you have to set this attribute to atm. **G703 modular interface** If you inserted a G703 modular interface, then the most important attributes that you have to configure are: • telindus1431Router/g703/coding on page 459. Use this attribute to set the G703 interface encoding mode: AMI or HDB3. • telindus1431Router/g703/framing on page 459. Use this attribute to select between unframed (transparent) mode or framed (fractional E1) mode. • telindus1431Router/g703/clocking on page 460. Use this attribute to select a clocking mode. • telindus1431Router/g703/channel[ ]/timeSlots on page 465. If you set the framing attribute to framed, then use the timeSlots attribute to enable or disable the individual 64 kbps time slots in the framed data stream. • telindus1431Router/<modularIf>/encapsulation on page 457. In case of ATM switching, you have to set this attribute to atm.
5	If desired, you can fine-tune the ATM related parameters of the modular interface. Do this using the attribute telindus1431Router/<modularIf>/atm/atm on page 424.

Important remark

- As mentioned above, in case of ATM switching you configure the PVCs in the atmSwitching table. *So do not use the pvcTable in the atm object to configure the PVCs in case of ATM switching!*
- Note however, that if you want to create ATM PVCs for routing and/or bridging the LAN data, then you have to create them in the pvcTable. Make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the atmSwitching table and vice versa.
- The status and performance information of the PVCs you created in the configuration atmSwitching table can be found in …
  - the status pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 591.
  - the performance pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 702.

9 Configuring the encapsulation protocols

This chapter introduces the encapsulation protocols that can be used on the Telindus 1431 SHDSL CPE and lists the attributes you can use to configure the encapsulation protocols.

The following gives an overview of this chapter:

- 9.1 - Configuring ATM encapsulation on page 128
- 9.2 - Configuring Frame Relay encapsulation on page 156
- 9.3 - Configuring CES encapsulation on page 164
- 9.4 - Configuring PPP encapsulation (in case of PPPo…) on page 167
- 9.5 - Bandwidth control on Telindus 1431 SHDSL CPE on page 183

Refer to the Reference manual on page 377 for a complete overview of the attributes of the Telindus 1431 SHDSL CPE.

9.1 Configuring ATM encapsulation

This section introduces the ATM encapsulation protocol and gives a short description of the attributes you can use to configure this encapsulation protocol.

The following gives an overview of this section:

- 9.1.1 - Introducing ATM on page 129
- 9.1.2 - Configuring the different ATM PVCs on page 137
- 9.1.3 - Configuring ATM PVCs (IP LAN PVC) on page 140
- 9.1.4 - Automatically obtaining IP addresses in ATM on page 142
- 9.1.5 - Configuring IP addresses in ATM on page 143
- 9.1.6 - Configuring the VPI and VCI on page 144
- 9.1.7 - Configuring UBR on page 145
- 9.1.8 - Configuring VBR-nrt on page 146
- 9.1.9 - Configuring VBR-rt on page 147
- 9.1.10 - Configuring CBR on page 148
- 9.1.11 - ATM PVC bandwidth assignment on page 149
- 9.1.12 - Configuring bridged/routed Ethernet/IP over ATM (RFC 2684) on page 151
- 9.1.13 - Configuring Classical IP (IPoA) on page 152
- 9.1.14 - Configuring PPP over ATM (PPPoA) on page 153
- 9.1.15 - Configuring PPP over Ethernet (PPPoE) on page 154
- 9.1.16 - Configuring a low speed ATM PVC on page 155

9.1.1 Introducing ATM

What is ATM?

ATM is a cell-switching and multiplexing technology that combines the benefits of circuit switching (guaranteed capacity and constant transmission delay) with those of packet switching (flexibility and efficiency for intermittent traffic). It provides scalable bandwidth. Because of its asynchronous nature, ATM is more efficient than synchronous technologies, such as time-division multiplexing (TDM).

With TDM, each user is assigned a time slot, and no other station can send in that time slot. If a station has much data to send, it can send only when its time slot comes up, even if all other time slots are empty. However, if a station has nothing to transmit when its time slot comes up, the time slot is sent empty and is wasted. Because ATM is asynchronous, time slots are available on demand with information identifying the source of the transmission contained in the header of each ATM cell.

What is VPI and VCI?

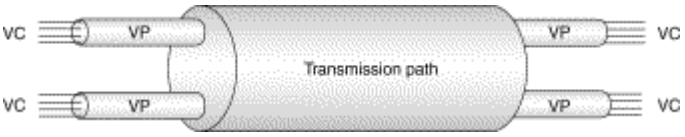
ATM networks are fundamentally connection-oriented, which means that a virtual channel must be set up across the ATM network prior to any data transfer. (A virtual channel is roughly equivalent to a Permanent Virtual Circuit or PVC.)

Two types of ATM connections exist:

- virtual paths, which are identified by Virtual Path Identifiers (VPIs).
- virtual channels, which are identified by the combination of a VPI and a Virtual Channel Identifier (VCI).

A virtual path is a bundle of virtual channels, all of which are switched transparently across the ATM network based on the common VPI. All VPIs and VCIs, however, have only local significance across a particular link and are remapped, as appropriate, at each switch.

A transmission path is the physical media that transports virtual channels and virtual paths. The following figure illustrates how VCs concatenate to create VPs, which, in turn, traverse the media or transmission path.



What are the ATM layers?

The ATM reference model is composed of the following ATM layers:

Layer	Description
physical layer	Analogous to the physical layer of the OSI reference model, the ATM physical layer manages the medium-dependent transmission.
ATM layer	Combined with the ATM adaptation layer, the ATM layer is roughly analogous to the data link layer of the OSI reference model. The ATM layer is responsible for the simultaneous sharing of virtual circuits over a physical link (cell multiplexing) and passing cells through the ATM network (cell relay). To do this, it uses the VPI and VCI information in the header of each ATM cell.
ATM Adaptation Layer (AAL)	Combined with the ATM layer, the AAL is roughly analogous to the data link layer of the OSI model. The AAL is responsible for isolating higher-layer protocols from the details of the ATM processes. The adaptation layer prepares user data for conversion into cells and segments the data into 48-byte cell payloads. At present, the four types of AAL recommended by the ITU-T are AAL1, AAL2, AAL3/4, and AAL5: • AAL1 is used for connection-oriented, delay-sensitive services requiring constant bit rates, such as uncompressed video and other isochronous traffic. • AAL2 is used for connection-oriented services that support a variable bit rate, such as some isochronous video and voice traffic. • AAL3/4 (merged from two initially distinct adaptation layers) supports both connectionless and connection-oriented links but is used primarily for the transmission of SMDS packets over ATM networks. • AAL5 supports connection-oriented VBR services and is used predominantly for the transfer of classical IP over ATM and LANE traffic. AAL5 uses SEAL and is the least complex of the current AAL recommendations. It offers low bandwidth overhead and simpler processing requirements in exchange for reduced bandwidth capacity and error-recovery capability.
higher layers	Finally, the higher layers residing above the AAL accept user data, arrange it into packets, and hand it to the AAL.

What are ATM service categories?

The Traffic Management Specification Version 4.0 defines five ATM service categories that describe the traffic transmitted by users onto a network and the Quality of Service (QoS) that a network needs to provide for that traffic. The five service categories are:

- Constant Bit Rate (CBR)
- Variable Bit Rate real-time (VBR-rt)
- Variable Bit Rate non-real-time (VBR-nrt)
- Available Bit Rate (ABR)
- Unspecified Bit Rate (UBR)

The Telindus 1431 SHDSL CPE supports CBR, VBR-rt, VBR-nrt and UBR.

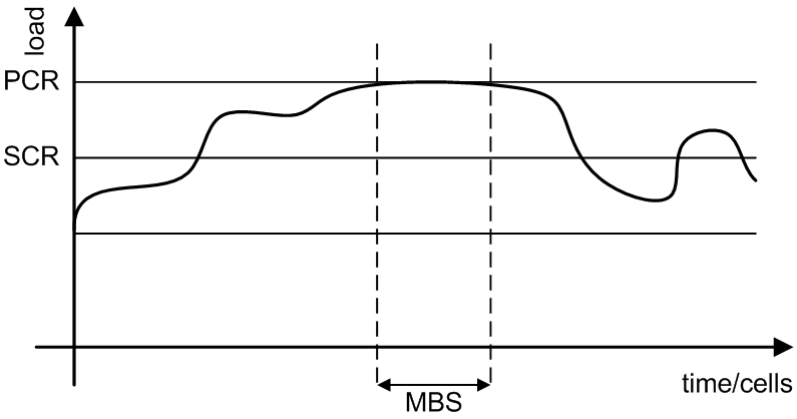
CES typically requires CBR. So in case you use CES, the Telindus 1431 SHDSL CPE automatically uses the CBR service category.

Which are the ATM service category traffic parameters?

The traffic parameters with which you can configure the ATM service categories are:

Traffic parameter	Description
PCR	The Peak Cell Rate (PCR) is the maximum rate at which you expect to transmit data. Obviously, the maximum possible PCR is the physical speed of the customer's access circuit into the ATM service provider.
SCR	The Sustainable Cell Rate (SCR) is the sustained rate at which you expect to transmit data. Consider the SCR to be the true bandwidth of a PVC and not the long-term average traffic rate.
MBS	The Maximum Burst Size (MBS) is the amount of time or the duration at which the router sends at PCR (in other words, it declares how many cells can be transmitted at PCR). Calculate this time in seconds using the following formula: T = (burst cells x 424 bits per cell) / (PCR - SCR) MBS will accommodate temporary bursts or short spikes in the traffic pattern. For example, an MBS of 100 cells allows a burst of three MTU-size Ethernet frames. It is important that you factor longer duration bursts into the SCR.

The following figure shows the PCR, SCR and MBS relationship:



What is UBR?

The Unspecified Bit Rate (UBR) service category is a "best effort" service intended for non-critical applications, which do not require tightly constrained delay and delay variation, nor a specified quality of service. UBR sources are expected to transmit non-continuous bursts of cells. UBR service supports a high degree of statistical multiplexing among sources.

UBR service does not specify traffic related service guarantees. Specifically, UBR does not include the notion of a per-connection negotiated bandwidth. There may not be any numerical commitments made as to the cell loss ratio experienced by a UBR connection, or as to the cell transfer delay experienced by cells on the connection.

The only traffic parameter you have to configure in case of UBR is the PCR. The PCR only provides an indication of a physical bandwidth limitation within a PVC.

Examples of applications which can be seen as appropriate targets for the UBR service category are: data transfer, messaging, etc.

What is VBR-nrt?

The non-real time VBR service category is intended for applications which have bursty traffic characteristics and do not have tight constraints as to delay and delay variation. For those cells which are transferred within the traffic contract, the application expects a low Cell Loss Ratio (CLR). For all cells, it expects a bound on the Cell Transfer Delay (CTD). Non-real time VBR service may support statistical multiplexing of connections.

The traffic parameters you have to configure in case of VBR-nrt are:

- the Sustainable Cell Rate (SCR)
- the Peak Cell Rate (PCR)
- the Maximum Burst Size (MBS)

Examples of applications which can be seen as appropriate targets for the VBR-nrt service category are: response-time critical transaction processing applications (e.g. airline reservations, banking transactions, process monitoring), etc.

What is VBR-rt?

The real-time VBR service category is intended for time-sensitive applications, (i.e., those requiring tightly constrained delay and delay variation), as would be appropriate for voice and video applications. Sources are expected to transmit at a rate which varies with time. Equivalently, the source can be described as "bursty".

Cells which are delayed beyond the value specified by CTD are assumed to be of significantly less value to the application. Real-time VBR service may support statistical multiplexing of real-time sources.

The traffic parameters you have to configure in case of VBR-rt are:

- the Sustainable Cell Rate (SCR)
- the Peak Cell Rate (PCR)
- the Maximum Burst Size (MBS)

Examples of applications which can be seen as appropriate targets for the VBR-rt service category are: some classes of multimedia communications (e.g. compressed audio, interactive multimedia), etc.

What is CBR?

The CBR service category is used by connections that request a fixed (static) amount of bandwidth, characterized by a Peak Cell Rate (PCR) value that is continuously available during the connection lifetime. The source may emit cells at or below the PCR at any time, and for any duration (or may be silent).

This category is intended for real-time applications, i.e., those requiring tightly constrained Cell Transfer Delay (CTD) and Cell Delay Variation (CDV), but is not restricted to these applications. It would be appropriate for voice and video applications, as well as for Circuit Emulation Services (CES).

The basic commitment made by the network is that once the connection is established, the negotiated QoS is assured to all cells conforming to the relevant conformance tests. It is assumed that cells which are delayed beyond the value specified by Cell Transfer Delay (CTD) may be of significantly less value to the application.

The only traffic parameter you have to configure in case of CBR is the PCR.

Examples of applications which can be seen as appropriate targets for the CBR service category are: video conferencing, interactive audio (e.g., telephony), audio/video distribution (e.g. television, distance learning), audio/video retrieval (e.g. video-on-demand, audio library)

What is multi-protocol over ATM (MPoA)?

As its name implies, multi-protocol encapsulation over ATM provides mechanisms for carrying traffic other than just IP. Several different protocols can be used on top of ATM:

- Bridged/routed Ethernet/IP over ATM (formerly RFC 1483, now RFC 2684). This protocol makes the router appear as a LAN device to the operating system.
- IP over ATM (IPoA, RFC 1577, similar to RFC 2684). Also in this case the protocol makes the router appear as a LAN device to the operating system.
- Point to Point Protocol Over ATM (PPPoA, RFC 2364). PPP provides session setup, user authentication (login), and encapsulation for upper layer protocols such as IP. The use of PPP makes the router appear as a dial device to the operating system.
- Point to Point Protocol Over Ethernet (PPPoE, RFC 2516). This protocol makes the router appear as a LAN device to the operating system. It allows multiple devices on an Ethernet to share a common connection to the remote network (e.g. the Internet).

Which are the multi-protocol over ATM encapsulation mechanisms?

As said before, you can encapsulate several protocols in ATM. The mechanisms to do this are:

MPoA encapsulation mechanism	Description
Logical Link Control (LLC) encapsulation	In this method, multiple protocol types can be carried across a single connection with the type of encapsulated packet identified by a standard LLC/SNAP header.
Virtual Connection Multiplexing	In this method, only a single protocol is carried across an ATM connection, with the type of protocol implicitly identified at connection setup.

LLC encapsulation is provided to support routed and bridged protocols. In this encapsulation format, PDUs from multiple protocols can be carried over the same virtual connection. The type of protocol is indicated in the packet's SNAP header. By contrast, the virtual connection multiplexing method allows for transport of just one protocol per virtual connection.

The following table gives an overview of which multi-protocol mechanism can be used for which higher layer protocol encapsulation.

higherLayerProtocol	multiProtocolMech
rfc2684	llcEncapsulation + vcMultiplexing
ppp	llcEncapsulation + vcMultiplexing
pppOverEthernet	llcEncapsulation

What is PPPoA (RFC 2364)?

PPP over ATM adaptation layer 5 (AAL5) uses AAL5 as the framed protocol. It relies on RFC 2684, operating in either Logical Link Control Encapsulation or Virtual Connection Multiplexing mode. A Customer Premises Equipment (CPE) device encapsulates the PPP session based on this RFC for transport across the xDSL loop and the Digital Subscriber Line Access Multiplexer (DSLAM).

What is PPPoE over ATM (RFC 2516)?

PPP over Ethernet (PPPoE) over ATM actually combines three protocols: Ethernet, PPP and ATM. The Ethernet is encapsulated in PPP which, on its turn, is encapsulated in ATM:

- The Ethernet protocol provides the ability to connect a network of hosts over a simple bridging access device to a remote access concentrator.
- The PPP protocol provides the ability that each host utilises its own PPP stack and that the user is presented with a familiar user interface. Access control, billing and type of service can be done on a per-user basis, rather than on a per-site basis.
- The ATM protocol provides service-provider digital subscriber line (DSL) support.

What is PPPoE (RFC 2516)?

PPP over Ethernet (PPPoE) provides the ability to connect a network of hosts over a simple bridging access device to a remote access concentrator. With this model, each host utilises its own PPP stack and the user is presented with a familiar user interface. Access control, billing and type of service can be done on a per-user basis, rather than on a per-site basis.

PPPoE has two distinct stages:

- a discovery stage.
- a PPP session stage.

When a host wants to initiate a PPPoE session, it must first perform discovery to identify the Ethernet MAC address of the peer and establish a PPPoE session ID. While PPP defines a peer-to-peer relationship, discovery is inherently a client-server relationship. In the discovery process, a host (the client) discovers an access concentrator (the server). Based on the network topology, there may be more than one access concentrator that the host can communicate with. The discovery stage allows the host to discover all access concentrators and then select one. When discovery completes successfully, both the host and the selected access concentrator have the information they will use to build their point-to-point connection over Ethernet.

The discovery stage remains stateless until a PPP session is established. Once a PPP session is established, both the host and the access concentrator must allocate the resources for a PPP virtual interface.

What are OAM LoopBack (LB) cells?

The ATM protocol features OAM LoopBack (LB) cells. These are used to verify whether a Virtual Channel/Path is truly up or down. This can be done on two levels:

- on Virtual Path (VP) level by using OAM F4 LB cells. The relevant configuration attributes can be found in the vp table.
- on Virtual Channel (VC) level by using OAM F5 LB cells. The relevant configuration attributes can be found in the pvcTable (for ATM PVCs) and frAtm table (for FRF PVCs).

The Telindus 1431 SHDSL CPE always responds to OAM LB cells received from the peer ATM device (both segment and end-to-end cells). However, when OAM LB is activated, the Telindus 1431 SHDSL CPE only sends end-to-end OAM LB request cells.

What are OAM Continuity Check (CC) cells?

The ATM protocol features OAM Continuity Check (CC) cells. These are used to continuously monitor the continuity of a Virtual Channel/Path. This can be done on two levels:

- on Virtual Path (VP) level by using OAM F4 CC cells. The relevant configuration attributes can be found in the vp table.
- on Virtual Channel (VC) level by using OAM F5 CC cells. The relevant configuration attributes can be found in the pvcTable (for ATM PVCs) and frAtm table (for FRF PVCs).

The CC mechanism can be activated/deactivated …

- manually.
- by using activator/deactivator cells.

What is CLP?

The Cell Loss Priority (CLP) indicates whether the cell should be discarded if it encounters extreme congestion as it moves through the network. If the CLP bit equals 1, the cell should be discarded in preference to cells with the CLP bit equal to 0.

What is EFCI?

The Explicit Forward Congestion Indication (EFCI) indicates whether a cell containing user data experienced congestion as it moved through the network.

9.1.2 Configuring the different ATM PVCs

On the Telindus 1431 SHDSL CPE you can create three types of ATM PVCs:

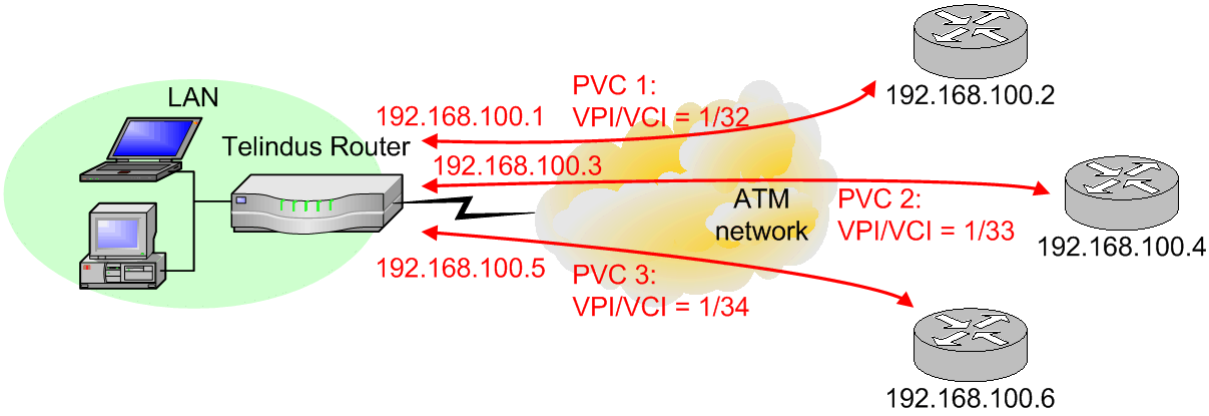
- IP LAN PVCs,
- FRF PVCs,
- CES PVCs.

Each type of ATM PVC has to be configured in a different PVC table:

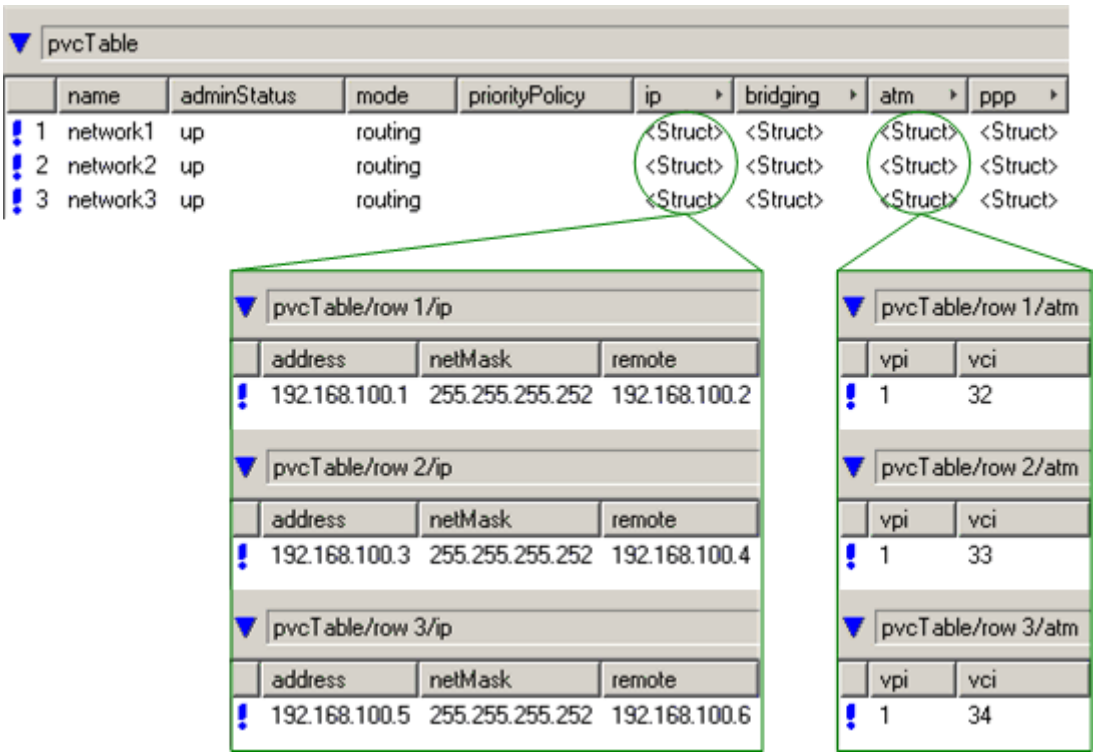
ATM PVC type	In which table do you have to configure this ATM PVC?
IP LAN PVC	ATM PVCs for routing and/or bridging the LAN data have to be created in the pvcTable. Refer to … • 9.1.3 - Configuring ATM PVCs (IP LAN PVC) on page 140 for more information. • telindus1431Router/wanInterface/atm/pvcTable on page 406.
FRF PVC	ATM PVCs for FRF purposes have to be created in the frAtm table. Refer to … • 6.2 - Setting up FRF links on page 95 for more information. • telindus1431Router/wanInterface/atm/frAtm on page 417.
CES PVC	ATM PVCs for CES purposes have to be created in the ces table. Refer to … • 7.2 - Setting up CES links on page 119 for more information. • telindus1431Router/wanInterface/atm/ces on page 420.

Example of an IP LAN PVC

The following figure gives an example of a local Ethernet segment connected to three different networks through three different PVCs:

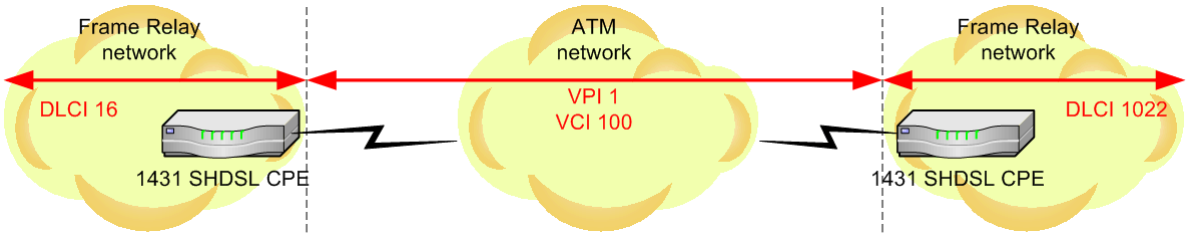


The following screenshot shows (part of) the pvcTable of the set-up depicted in the figure above:

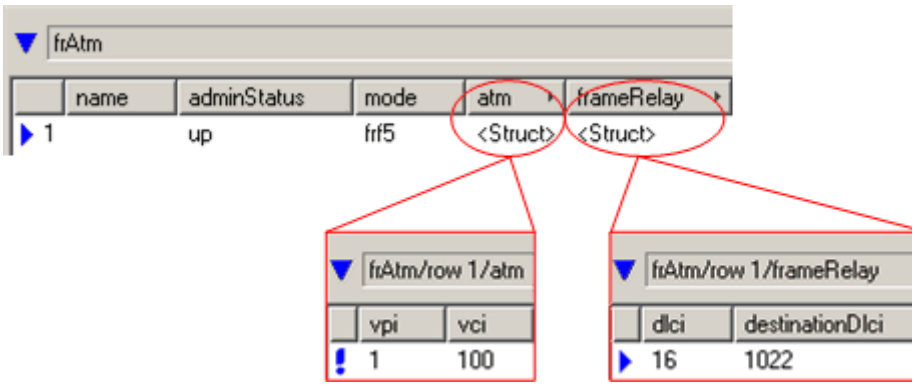


Example of an FRF PVC

The following figure gives an example of two Telindus 1431 SHDSL CPEs, both situated in a Frame Relay network and communicating with each other over an ATM network (i.e. FRF.5).

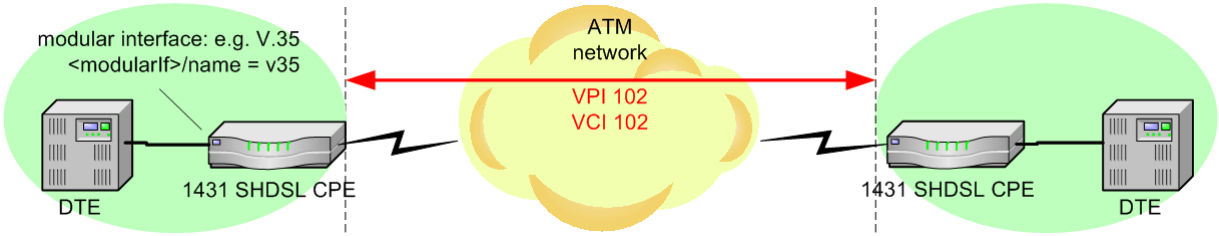


The following screenshot shows (part of) the frAtm table of the set-up depicted in the figure above:

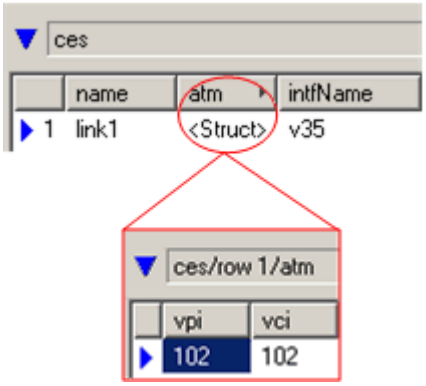


Example of a CES PVC

The following figure gives an example of two Telindus 1431 SHDSL CPEs, connected to each other over an ATM network and using CES to connect the DTEs:



The following screenshot shows the ces table of the set-up depicted in the figure above:



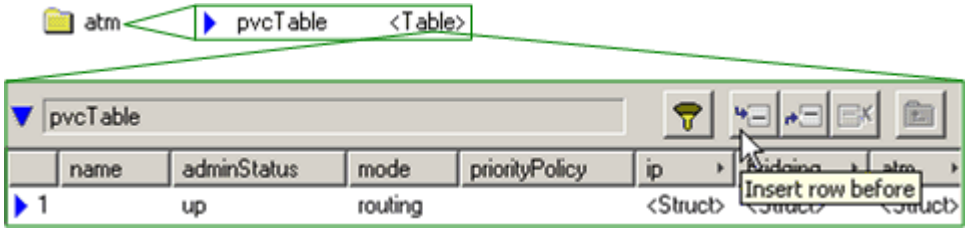
9.1.3 Configuring ATM PVCs (IP LAN PVC)

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction.

In an ATM network you can set-up PVCs. A PVC allows direct connectivity between sites. In this way, a PVC is similar to a leased line. A PVC guarantees availability of a connection and does not require call setup procedures between the ATM switches.

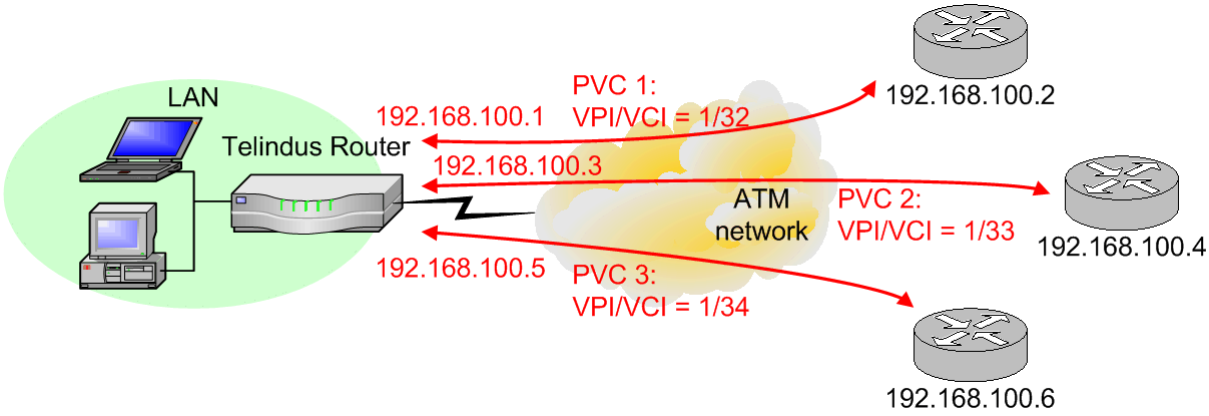
Note again that this procedure explains how to create ATM PVCs for routing and/or bridging the LAN data (i.e. IP LAN PVCs). To find out how to create ATM PVCs for the purpose of FRF and CES, refer to 6.2 - Setting up FRF links on page 95 and 7.2 - Setting up CES links on page 119.

To configure an ATM PVC (i.e. IP LAN PVCs), proceed as follows:

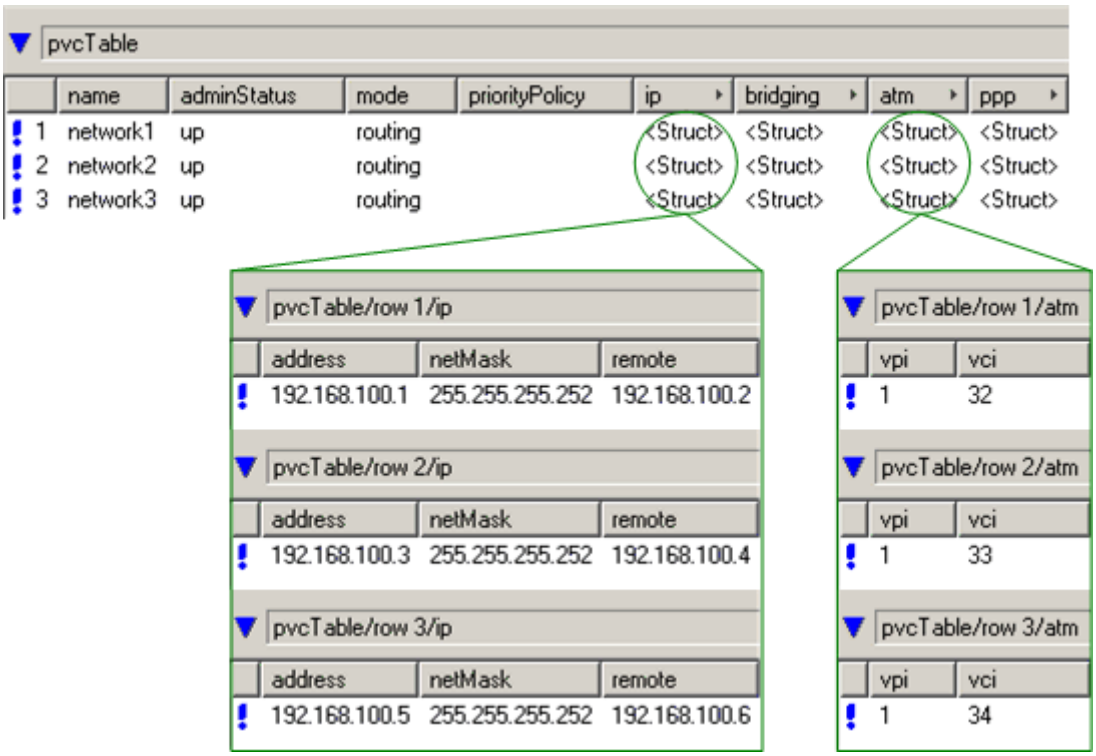
Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the atm object, select the pvcTable attribute and add one or more entries to this table.  Use this attribute to set up ATM PVCs. Add a row to the pvcTable for each ATM PVC you want to create.
2	Configure the elements of the ATM PVC you just created. These elements are: • name. Use this element to assign an administrative name to the ATM PVC. • adminStatus. Use this element to activate (up) or deactivate (down) the ATM PVC. • mode. Use this element to determine whether, for the corresponding ATM PVC, the packets are treated by the routing process, the bridging process or both. • priorityPolicy. Use this element to apply a priority policy on the ATM PVC. Refer to 10.8.7 - Applying a priority policy on an interface on page 250 for more information. • ip. Use this element to configure the IP related parameters of the ATM PVC. Refer to 5.2.3 - Explaining the ip structure on page 60 for more information. • bridging. Use this element to configure the bridging related parameters of the ATM PVC in case the PVC is in bridging mode (i.e. in case the mode element is set to bridging). Refer to 11.2.6 - Explaining the bridging structure on page 279 for more information. • atm. Use this element to configure the ATM specific parameters of the ATM PVC. Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for more information. • ppp. Use this element to configure the PPP related parameters of the ATM PVC in case you want to run PPP over ATM. Refer to 14.5.4 - PPPoA configuration attributes on page 438 for a detailed description of the elements in the ppp structure. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 406 for a detailed description of the pvcTable.

Example - configuring ATM PVCs_ (IP LAN PVC)

The following figure gives an example of a local Ethernet segment connected to three different networks through three different PVCs:



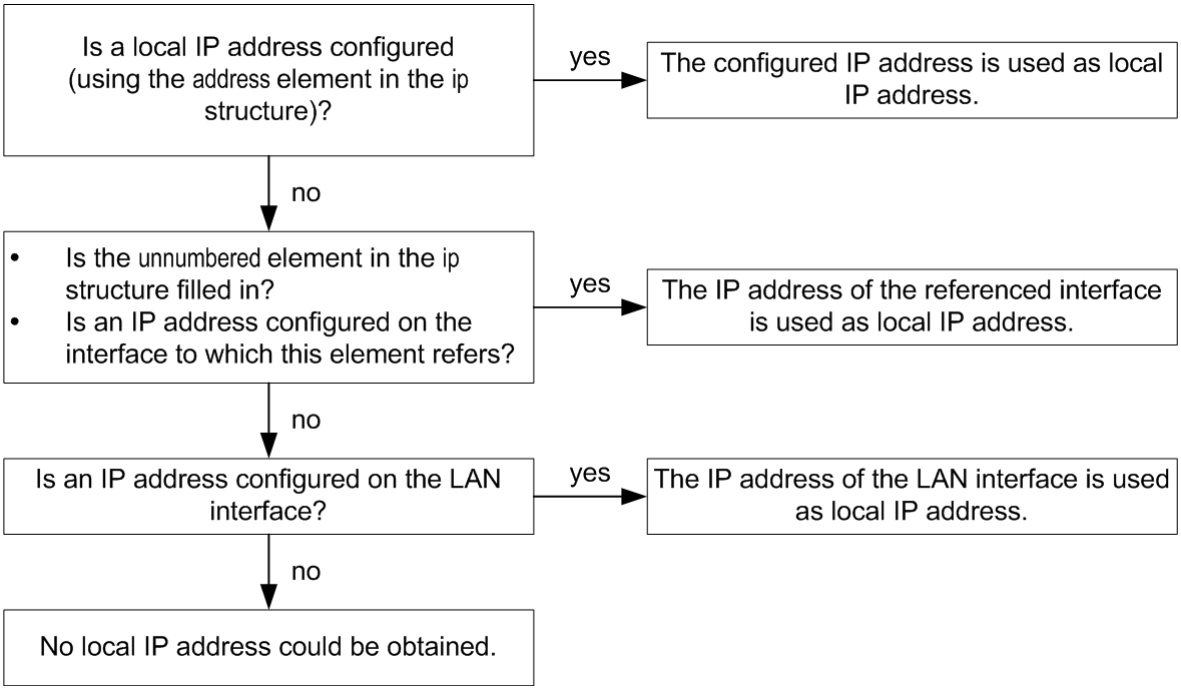
The following screenshot shows (part of) the pvcTable of the set-up depicted in the figure above:



9.1.4 Automatically obtaining IP addresses in ATM

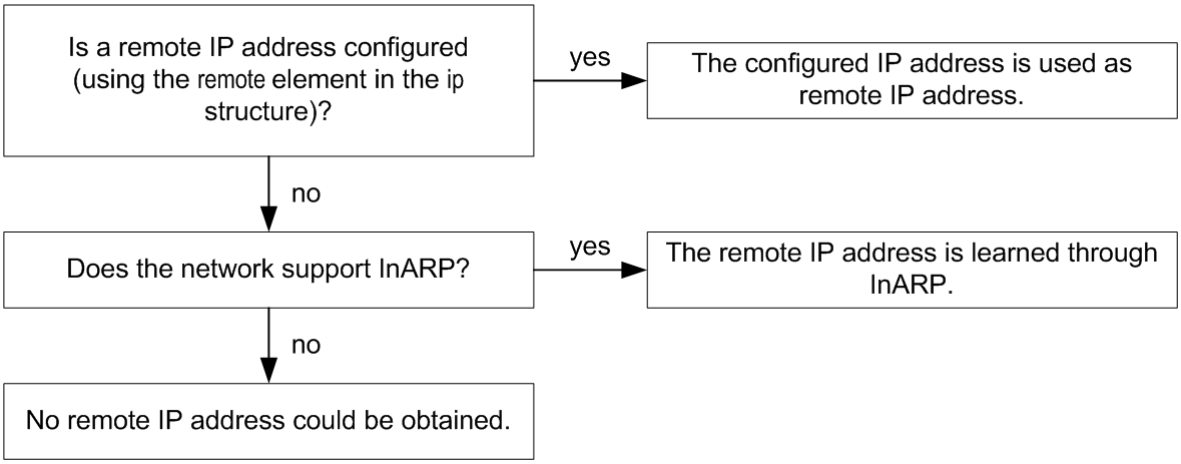
Obtaining a local IP address

In case of ATM, the Telindus 1431 SHDSL CPE can perform an auto-install (refer to 19 - Auto installing the Telindus 1431 SHDSL CPE on page 775). This includes obtaining a local IP address of the ATM PVC. However, even if no auto-install is performed the Telindus 1431 SHDSL CPE runs the following sequence to obtain a local IP address of the ATM PVC:


Is a local IP address configured (using the address element in the ip structure)?
yes
The configured IP address is used as local IP address.
no
Is the unnumbered element in the ip structure filled in?
Is an IP address configured on the interface to which this element refers?
yes
The IP address of the referenced interface is used as local IP address.
no
Is an IP address configured on the LAN interface?
yes
The IP address of the LAN interface is used as local IP address.
no
No local IP address could be obtained.

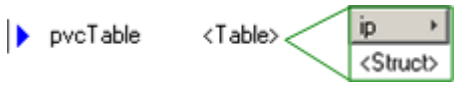
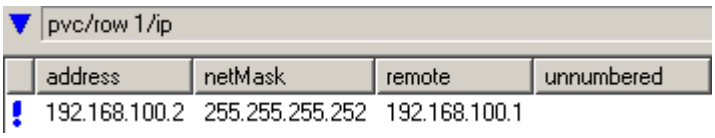
Obtaining a remote IP address

If the ATM network supports the InARP (Inverse Address Resolution Protocol) protocol, then the Telindus 1431 SHDSL CPE can learn the remote IP address of an ATM PVC.


Is a remote IP address configured (using the remote element in the ip structure)?
yes
The configured IP address is used as remote IP address.
no
Does the network support InARP?
yes
The remote IP address is learned through InARP.
no
No remote IP address could be obtained.

9.1.5 Configuring IP addresses in ATM

To configure IP addresses on an ATM PVC, proceed as follows:

Step	Action
1	In the pvcTable, select the ip structure. 
2	In the ip structure, configure the following elements: • address. Use this element to assign an IP address to the local end of the ATM PVC. • netMask. Use this element to assign an IP subnet mask to the local end of the ATM PVC. • remote. Use this element to assign an IP address to the remote end of the ATM PVC. • unnumbered. In case you do not explicitly configure a local IP address for an ATM PVC, then you can use this element to "borrow" the IP address of another interface for which an IP address is already configured. 

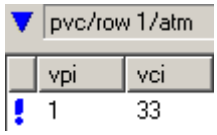
Refer to …

- 5.2.3 - Explaining the ip structure on page 60 for a complete description of the ip structure.
- Example - configuring ATM PVCs_ (IP LAN PVC) on page 141 for an example.

9.1.6 Configuring the VPI and VCI

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on VPI and VCI.

To configure the VPI and VCI of an ATM PVC, proceed as follows:

Step	Action
1	In the pvcTable, select the atm structure.
2	In the atm structure, configure the following elements: • vpi. Use this element to set the Virtual Path Identifier (VPI) of the ATM PVC. • vci. Use this element to set the Virtual Channel Identifier (VCI) of the ATM PVC. 

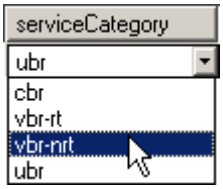
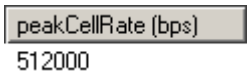
Refer to …

- telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for a complete description of the atm structure.
- Example - configuring ATM PVCs_ (IP LAN PVC) on page 141 for an example.

9.1.7 Configuring UBR

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on UBR and related traffic parameters.

To configure UBR on an ATM PVC, proceed as follows:

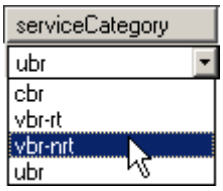
Step	Action
1	In the pvcTable, select the atm structure.
2	In the atm structure, set the serviceCategory element to ubr. 
3	In the atm structure, configure the UBR related traffic parameters. The only parameter you have to configure in case of UBR is the Peak Cell Rate (PCR). The PCR only provides an indication of a physical bandwidth limitation within a PVC. 

Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for a complete description of the atm structure.

9.1.8 Configuring VBR-nrt

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on VBR-nrt and related traffic parameters.

To configure VBR-nrt on an ATM PVC, proceed as follows:

Step	Action
1	In the pvcTable, select the atm structure.
2	In the atm structure, set the serviceCategory element to vbt-nrt. 
3	In the atm structure, configure the VBR-nrt related traffic parameters: • the Peak Cell Rate (PCR). • the Sustainable Cell Rate (SCR). • the Maximum Burst Size (MBS). The PCR and MBS must be understood only as mechanisms to reduce latency and not as a way to increase bandwidth. Thus, the PCR and MBS allow you to accommodate short duration bursts of traffic without packet drops taking place. If long duration bursts exist often in your specific traffic pattern, they should be taken under account when choosing the value for SCR. peakCellRate (bps) | sustCellRate (bps) | maxBurstSize (cellTimes) 256000 | 128000 | 100

Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for a complete description of the atm structure.

Calculating the burst size

From the MBS it is possible to figure out how many time, in seconds, the Telindus 1431 SHDSL CPE will be able to transmit at PCR, by means of the following equation:

T = (MBS x 424 bits per cell) / (PCR - SCR)

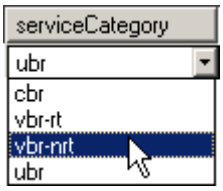
So suppose the SCR and PCR are known to be 64 kbps and 256 kbps and suppose you set the MBS to …

- 45 cells, then T = 100 ms which means you can have bursts up to approximately 3 kbytes.
- 90 cells, then T = 200 ms which means you can have bursts up to approximately 6 kbytes.

9.1.9 Configuring VBR-rt

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on VBR-rt and related traffic parameters.

To configure VBR-rt on an ATM PVC, proceed as follows:

Step	Action
1	In the pvcTable, select the atm structure.
2	In the atm structure, set the serviceCategory element to vbt-rt. 
3	In the atm structure, configure the VBR-rt related traffic parameters: • the Peak Cell Rate (PCR). • the Sustainable Cell Rate (SCR). • the Maximum Burst Size (MBS). The PCR and MBS must be understood only as mechanisms to reduce latency and not as a way to increase bandwidth. Thus, the PCR and MBS allow you to accommodate short duration bursts of traffic without packet drops taking place. If long duration bursts exist often in your specific traffic pattern, they should be taken under account when choosing the value for SCR. peakCellRate (bps) | sustCellRate (bps) | maxBurstSize (cellTimes) 256000 | 128000 | 100

Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for a complete description of the atm structure.

Calculating the burst size

From the MBS it is possible to figure out how many time, in seconds, the Telindus 1431 SHDSL CPE will be able to transmit at PCR, by means of the following equation:

T = (MBS x 424 bits per cell) / (PCR - SCR)

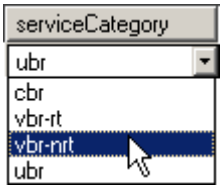
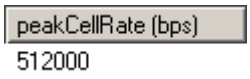
So suppose the SCR and PCR are known to be 64 kbps and 256 kbps and suppose you set the MBS to …

- 45 cells, then T = 100 ms which means you can have bursts up to approximately 3 kbytes.
- 90 cells, then T = 200 ms which means you can have bursts up to approximately 6 kbytes.

9.1.10 Configuring CBR

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on CBR and related traffic parameters.

To configure CBR on an ATM PVC, proceed as follows:

Step	Action
1	In the pvcTable, select the atm structure.
2	In the atm structure, set the serviceCategory element to cbr. 
3	In the atm structure, configure the CBR related traffic parameters. The only parameter you have to configure in case of CBR is the Peak Cell Rate (PCR). 

9.1.11 ATM PVC bandwidth assignment

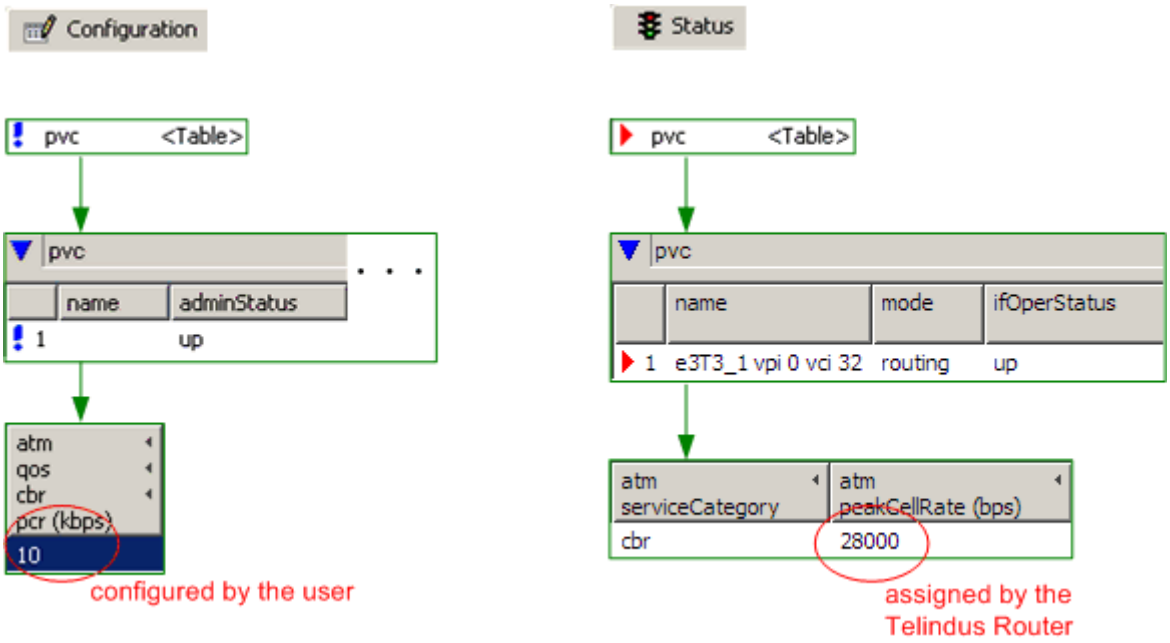
Bridging and routing

When selecting a certain service category for an ATM PVC, the Telindus 1431 SHDSL CPE assigns a certain amount of bandwidth to this ATM PVC. The amount of bandwidth that is assigned by the Telindus 1431 SHDSL CPE does not necessarily correspond with the amount of bandwidth that you configured.

The way the Telindus 1431 SHDSL CPE assigns bandwidth depends on factors such as available memory, the service category, the minimum bandwidth, etc. The most important factors are:

Factor	Description
service category importance	The higher the importance of the requested service category, the closer the assigned bandwidth comes to the requested bandwidth. The importance of the service categories in descending order is as follows: 1. CBR (high) 2. VBR-rt 3. VBR-nrt 4. UBR (low) Examples: • Suppose you select the service category UBR and you set the PCR to 8 kbps. In that case, it is possible that instead of 8 kbps, 16 kbps is assigned to the ATM PVC. • Suppose you select the service category CBR and you set the PCR to 8 kbps. In that case, it is possible that instead of 8 kbps, 9 kbps is assigned to the ATM PVC.
minimum requested bandwidth	The higher the requested bandwidth, the closer the assigned bandwidth comes to the requested bandwidth. Examples: • Suppose you select the service category UBR and you set the PCR to 8 kbps. In that case, it is possible that instead of 8 kbps, 16 kbps is assigned to the ATM PVC. This is a deviation of 50%. • Suppose you select the service category UBR and you set the PCR to 1024 kbps. In that case, it is possible that instead of 1024 kbps, 1032 kbps is assigned to the ATM PVC. This is a deviation of only +- 0.8%.

The amount of bandwidth that is assigned can be checked in the ATM status attributes.



Switching

In case of switched ATM PVCs, there is no QoS translation between source and destination. This would imply that when a switched ATM PVC comes through, it would get as much bandwidth as necessary to serve the incoming data stream. This would mean that if the switched ATM PVC carries a high bandwidth data stream, that the existing bridged or routed ATM PVCs (on the same physical interface) may suffer from this, even if their service category is CBR.

To avoid this, the priority configuration element has been added to the ATM switching table. Using this element, you can define in which “service category” the switched ATM PVC falls.

Switched ATM PVC priority	Corresponding “service category”
high	CBR
medium	VBR-rt
low	VBR-nrt

You can define a different priority for each switched ATM PVC. However, all switched ATM PVCs that have the same priority are treated equally.

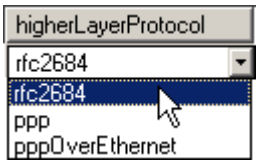
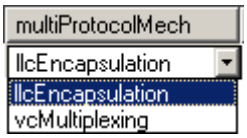
Examples:

- Setting the priority of a switched ATM PVC to high, makes it of equal priority as a bridged or routed ATM PVC with service category CBR. So both ATM PVCs will be treated equally as it comes to bandwidth assignment.
- Setting the priority of a switched ATM PVC to high, makes it of higher priority as a bridged or routed ATM PVC with service category VBR. So when the switched ATM PVC comes through, it will be given priority over the bridged or routed ATM PVC.

9.1.12 Configuring bridged/routed Ethernet/IP over ATM (RFC 2684)

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on bridged/routed Ethernet/IP over ATM.

To configure bridged/routed Ethernet/IP (multi-protocol) over ATM on an ATM PVC, proceed as follows:

Step	Action
1	In the pvcTable, select the atm structure.
2	In the atm structure, set the higherLayerProtocol element to rfc2684. By selecting this value you indicate that different types of protocol data units (PDUs) may be present in the traffic on this interface. 
3	Also in the atm structure, set the multiProtocolMech element to the desired encapsulation mechanism. By selecting one of these two values you indicate how the different types of protocol data units (PDUs) have to be encapsulated in ATM AAL type 5.  In case of … • llcEncapuslation, all the different PDU types are carried over a single PVC. In this case, the different PDU types can be distinguished from one another by the information in the Logical Link Control (LLC) header. • vcMultiplexing, each PDU type is carried over a separate PVC. So in this case, you have to set up as many PVCs as there are PDU types in your traffic. What is more, the remote application has to know which PVC carries which PDU type.

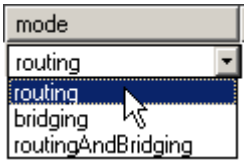
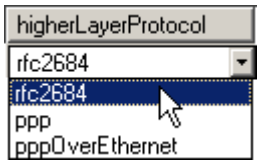
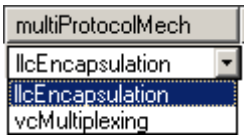
Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for a complete description of the atm structure.

9.1.13 Configuring Classical IP (IPoA)

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on IP over ATM.

Classical IP (RFC 1577) is one of the first commonly used encapsulations of IP over ATM. The encapsulation method is the same as described in RFC 2684 (formerly RFC 1483). The IP traffic is encapsulated without Ethernet header. Inverse ARP is in use for the resolution of IP addresses to PVC channels.

To configure Classical IP on an ATM PVC, proceed as follows:

Step	Action
1	In the pvcTable, set the mode element to routing. 
2	In the pvcTable, select the atm structure.
3	In the atm structure, set the higherLayerProtocol element to rfc2684. 
4	Also in the atm structure, set the multiProtocolMech element to the desired encapsulation mechanism: llcEncapuslation or vcMultiplexing. 

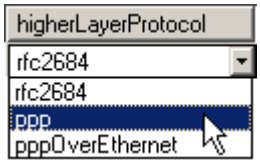
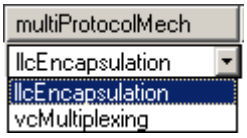
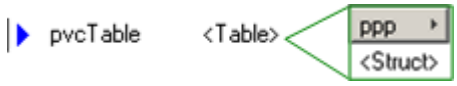
Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for a complete description of the atm structure.

Note that Inverse ARP is always in use. Therefore there is no dedicated attribute to enable or disable InARP.

9.1.14 Configuring PPP over ATM (PPPoA)

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on PPP over ATM.

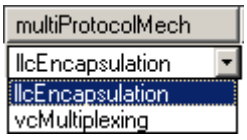
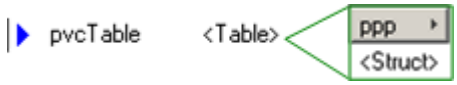
To configure PPP over ATM on an ATM PVC, proceed as follows:

Step	Action
1	In the pvcTable, select the atm structure.
2	In the atm structure, set the higherLayerProtocol element to ppp. 
3	Also in the atm structure, set the multiProtocolMech element to the desired encapsulation mechanism: llcEncapuslation or vcMultiplexing. 
4	In the pvcTable, select the ppp structure. 
5	In the ppp structure, configure the PPP elements (link monitoring, authentication, etc.). Refer to … • 9.4 - Configuring PPP encapsulation (in case of PPPo…) on page 167 for more information on configuring PPP. • 14.5.4 - PPPoA configuration attributes on page 438 for a detailed description of the elements in the ppp structure.

9.1.15 Configuring PPP over Ethernet (PPPoE)

Refer to 9.1.1 - Introducing ATM on page 129 for an introduction on PPP over Ethernet.

To configure PPP over Ethernet on an ATM PVC, proceed as follows:

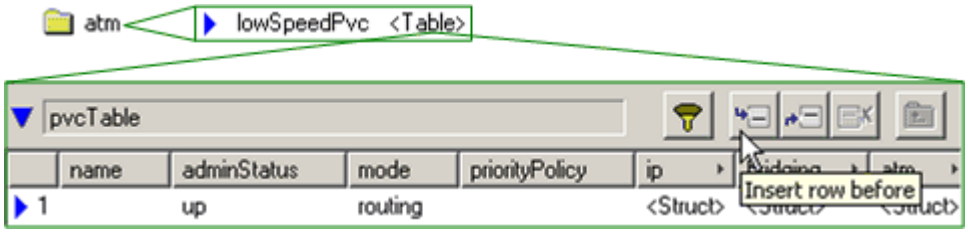
Step	Action
1	In the pvcTable, select the atm structure.
2	In the atm structure, set the higherLayerProtocol element to pppOverEthernet.
3	Also in the atm structure, set the multiProtocolMech element to llcEncapuslation. 
4	In the pvcTable, select the ppp structure. 
5	In the ppp structure, configure the PPP elements (link monitoring, authentication, etc.). Refer to … • 9.4 - Configuring PPP encapsulation (in case of PPPo…) on page 167 for more information on configuring PPP. • 14.5.4 - PPPoA configuration attributes on page 438 for a detailed description of the elements in the ppp structure.

9.1.16 Configuring a low speed ATM PVC

When using CES, you actually use the full bandwidth of the SHDSL line. This means that under normal circumstances you would not get any additional routed or bridged data over the line. This implies that you cannot carry management data across your network when using CES.

However, when enabling the Z-bits on the SHDSL line, you can increase the bandwidth of the SHDSL line. This additional bandwidth can then be used for a low speed PVC (5 ATM cells per second). This PVC can then be used, for example, to carry management data across your network.

To set up a low speed ATM PVC, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the wanInterface/line object and make sure the maxNrOfZ-Bits attribute is set to 1 (this is the default value).
2	Now, go to the atm object, select the lowSpeedPvc table and add an entry to this table. 
3	Configure the elements of the ATM PVC you just created. These elements are: • name. Use this element to assign an administrative name to the ATM PVC. • adminStatus. Use this element to activate (up) or deactivate (down) the ATM PVC. • mode. Use this element to determine whether, for the corresponding ATM PVC, the packets are treated by the routing process, the bridging process or both. • priorityPolicy. Use this element to apply a priority policy on the ATM PVC. Refer to 10.8.7 - Applying a priority policy on an interface on page 250 for more information. • ip. Use this element to configure the IP related parameters of the ATM PVC. Refer to 5.2.3 - Explaining the ip structure on page 60 for more information. • bridging. Use this element to configure the bridging related parameters of the ATM PVC in case the PVC is in bridging mode (i.e. in case the mode element is set to bridging). Refer to 11.2.6 - Explaining the bridging structure on page 279 for more information. • atm. Use this element to configure the ATM specific parameters of the ATM PVC. Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for more information. Note that the low speed PVC has a fixed bandwidth (PCR=2120 bps (5 ATM cells per second), CDV = 1 ms). Therefore, the atm structure does not contain the elements peakCellRate, sustCellRate and maxBurstSize. • ppp. Use this element to configure the PPP related parameters of the ATM PVC in case you want to run PPP over ATM. Refer to 14.5.4 - PPPoA configuration attributes on page 438 for a detailed description of the elements in the ppp structure.

9.2 Configuring Frame Relay encapsulation

When using the Frame Relay to ATM interworking function of the Telindus 1431 SHDSL CPE (refer to 6 - Configuring Frame Relay to ATM interworking on page 93), you have to configure some Frame Relay related configuration attributes. Therefore, this section introduces the Frame Relay encapsulation protocol and gives a short description of the attributes you can use to configure this encapsulation protocol.

The following gives an overview of this section:

- 9.2.1 - Introducing Frame Relay on page 157
- 9.2.2 - Configuring LMI on page 161
- 9.2.3 - Configuring CIR and EIR on page 162

9.2.1 Introducing Frame Relay

What is Frame Relay?

Frame Relay is a networking protocol that works at the bottom two levels of the OSI reference model: the physical and data link layers. It is an example of packet-switching technology, which enables end stations to dynamically share network resources.

Frame Relay devices fall into the following two general categories:

- Data Terminal Equipment (DTEs), which include terminals, personal computers, routers, and bridges.
- Data Circuit Equipment (DCEs), which transmit the data through the network and are often carrier-owned devices.

What is a DLCI?

Frame Relay networks transfer data using one of the following connection types:

- Switched Virtual Circuits (SVCs), which are temporary connections that are created for each data transfer and then are terminated when the data transfer is complete (not a widely used connection).
- Permanent Virtual Circuits (PVCs), which are permanent connections.

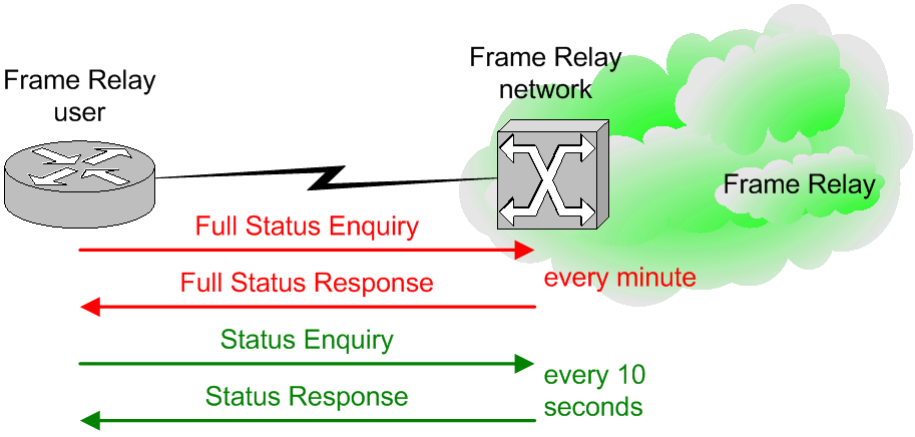
The Telindus 1431 SHDSL CPE makes use of Permanent Virtual Circuits. The Data Link Connection Identifier (DLCI) is a value assigned to each virtual circuit and DTE device connection point in the Frame Relay WAN. Two different connections can be assigned the same value within the same Frame Relay WAN, one on each side of the virtual connection.

What is LMI?

A set of Frame Relay enhancements exists, called the Local Management Interface (LMI). The LMI enhancements offer a number of features (referred to as extensions) for managing complex networks, including:

- global addressing,
- virtual circuit status messages,
- multicasting.

LMI provides a status mechanism which gives an on-going status report on the DLCIs. These status reports are exchanged between the Frame Relay access device (or Frame Relay DTE or user) and Frame Relay node (or Frame Relay DCE or network).



At regular intervals (typically every 1 minute), the Frame Relay user (e.g. a router) sends Full Status Enquiry messages to the Frame Relay network (e.g. a Frame Relay switch). On its turn, the Frame Relay network sends a Full Status Response to the Frame Relay user. In this response the Frame Relay network reports which DLCIs are configured at its side and which of these DLCIs are up or down. Until the first Full Status Enquiry exchange has occurred, the Frame Relay user does not know which DLCIs are active and so no data transfer can take place.

At smaller intervals (typically every 10 seconds), the Frame Relay user sends Status Enquiry messages to the Frame Relay network. On its turn, the Frame Relay network sends a Status Response to the Frame Relay user. In this response the Frame Relay network only reports which DLCIs are up or down.

There are various LMI versions: LMI rev.1, ANSI T1.617 Annex D, Q.933 Annex A, etc. To ensure interoperability when your network consists of equipment from different vendors, the same version of LMI protocol must be at each end of the Frame Relay link.

What is CIR and BC?

- CIR = BC / TC
- The Committed Information Rate (CIR) is the specified amount of guaranteed bandwidth (measured in bits per second) on a Frame Relay service. Typically, when purchasing a Frame Relay service the customer can specify the CIR level he wishes. The Frame Relay network provider guarantees that traffic not exceeding this level will be delivered.
- The Committed Burst (BC) is the maximum amount of data (in bits) that the network agrees to transfer, under normal conditions, during a time interval TC.

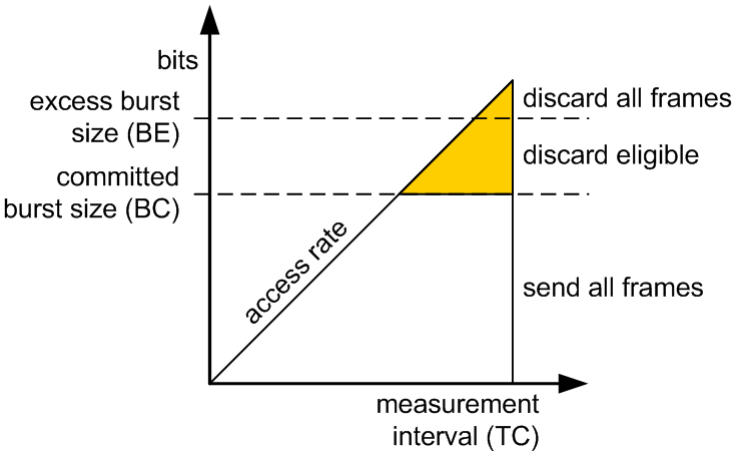
What is EIR and BE?

- EIR = BE / TC
- The Excess Information Rate (EIR) is the specified amount of unguaranteed bandwidth (measured in bits per second) on a Frame Relay service. It is the traffic in excess of the CIR. This traffic may also be delivered, but this is not guaranteed.
- The Excess Burst (BE) is the maximum amount of uncommitted data (in bits) in excess of BC that a Frame Relay network can attempt to deliver during a time interval TC. Generally, BE data is delivered with a lower probability than BC, and the network treats it as discard eligible.

What is TC?

The measurement interval (TC) is the time over which rates and burst sizes are measured. In general, the duration of TC is proportional to the burstiness of traffic.

The following figure shows the relationship between BC, BE and TC:



What is DE?

When the CIR is exceeded, all subsequent frames get marked Discard Eligible by setting the Discard Eligible (DE) bit in the Frame Relay header. This is performed at the local Frame Relay switch. If congestion occurs at a node in the Frame Relay network, packets marked DE are the first to be dropped. Upon detecting congestion, a Frame Relay switch will send a Backward Explicit Congestion Notifier (BECN) message back to the source. If the source (e.g. the router) has sufficient intelligence to process this message, it may throttle back to the CIR.

What is BECN?

Backward Explicit Congestion Notification (BECN) is a bit set by a Frame Relay network in frames travelling in the opposite direction of frames encountering a congested path. DTEs receiving frames with the BECN bit set can request that higher-level protocols take flow control action as appropriate.

What is FECN?

Forward Explicit Congestion Notification (FECN) is a bit set by a Frame Relay network to inform DTEs receiving the frame that congestion was experienced in the path from source to destination. DTEs receiving frames with the FECN bit set can request that higher-level protocols take flow-control action as appropriate.

What is interface Frame Relay fragmentation?

Interface fragmentation is used in order to allow real-time and data frames to share the same (physical) interface. The fragmentation is strictly local to the interface and provides the proper delay and delay variation based upon the logical speed of the interface (the logical speed of an interface may be slower than the physical clocking rate if a channelised physical interface is used). Since fragmentation is local to the interface, the network can take advantage of the higher internal trunk speeds by transporting the complete frames, which is more efficient than transporting a larger number of smaller fragments.

Interface fragmentation is also useful when there is a speed mismatch between the two DTEs at the ends of a VC. It also allows the network to proxy for a DTE that does not implement end-to-end fragmentation. Refer to What is end-to-end Frame Relay fragmentation? on page 160.

Interface fragmentation is *not* transparent to the Frame Relay network. I.e. the Frame Relay switches in the network have to “understand” Frame Relay fragmentation.

Interface fragmentation is provisioned on an interface-by-interface basis. When Interface fragmentation is used on an interface, then all frames on all DLCIs (including DLCI 0) are preceded by the fragmentation header.

Refer to FRF.12 for more information on Frame Relay fragmentation.

What is end-to-end Frame Relay fragmentation?

End-to-end Frame Relay fragmentation is used on DLCIs only. It is most useful when peer Frame Relay DTEs wish to exchange both real-time and non-real-time traffic using slower interface(s), but either one or both (physical) interfaces does not support interface Frame Relay fragmentation. Refer to What is interface Frame Relay fragmentation? on page 159.

End-to-end Frame Relay fragmentation is transparent to the Frame Relay network. I.e. the Frame Relay switches in the network do not have to “know” about the fragmentation.

Because DLCI 0 is never carried end-to-end, it is never fragmented using end-to-end Frame Relay fragmentation.

Refer to FRF.12 for more information on Frame Relay fragmentation.

What is MLFR?

Multilink Frame Relay (MLFR) provides physical interface emulation for Frame Relay devices. The emulated physical interface consists of one or more physical links, called "bundle links", aggregated together into a single "bundle" of bandwidth. This service provides a frame-based inverse multiplexing function, sometimes referred to as an "IMUX".

The bundle provides the same order-preserving service as a physical layer for frames sent on a data link connection. In addition, the bundle provides support for all Frame Relay services based on UNI and NNI standards.

Refer to FRF.16 for more information on multilink Frame Relay.

What is LIP?

The Link Integrity Protocol (LIP) features a set of control messages to insure the integrity of a Frame Relay bundle. These messages are:

LIP message	Description
Add Link	The Add Link message notifies the peer endpoint that the local endpoint supports frame processing. The message includes information required to verify bundle membership and detect loopbacks. Both ends of a bundle link generate this message when a bundle link endpoint is ready to become operational.
Add Link Acknowledge	The Add Link Acknowledge message notifies the peer endpoint that the local endpoint has received a valid Add Link message.
Add Link Reject	The Add Link Reject message notifies the peer endpoint that the local endpoint has received an invalid Add Link message.
Hello	The Hello message notifies the peer endpoint that the local endpoint remains in the state up. Both ends of a bundle link generate this message on a periodic basis.
Hello Acknowledge	The Hello Acknowledge message notifies the peer that the local endpoint has received a valid Hello message.
Remove Link	The Remove Link message notifies the peer that the local end layer management function is removing the bundle link from bundle operation.
Remove Link Acknowledge	The Remove Link Acknowledge message notifies the peer that the local end has received a Remove Link message.

9.2.2 Configuring LMI

Refer to 9.2.1 - Introducing Frame Relay on page 157 for an introduction on LMI.

To configure LMI, proceed as follows:

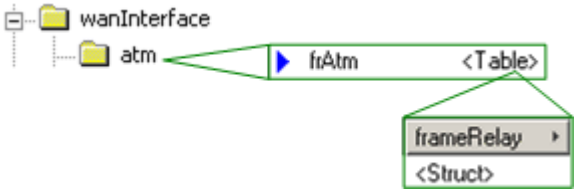
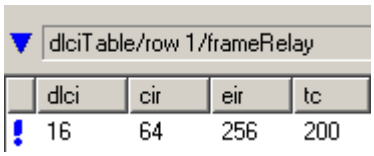
Step	Action
1	In the frameRelay object, select the lmi structure.
2	The most important elements in the lmi structure are: • mode. Use this element to set the Frame Relay mode (user, network, auto or nni). • type. Use this element to set the LMI variant. There are several standards for the LMI protocol with small variations between them. Therefore you should configure the Telindus 1431 SHDSL CPE according to the standard that is used by your service provider. Refer to telindus1431Router/<modularIf>/frameRelay/lmi on page 429 for a complete description of the lmi structure.

9.2.3 Configuring CIR and EIR

Refer to 9.2.1 - Introducing Frame Relay on page 157 for an introduction on CIR and EIR.

As said before, CIR is the data rate which the user expects to pass into the Frame Relay network with few problems. Note that the CIR is unrelated to the actual bit rate of the physical connection. A user could have a physical connection operating at 2 Mbps, but a CIR across this physical connection of only 64 kbps. This would mean that the user's average data rate would be 64 kbps, but data bursts up to 2 Mbps would be possible (EIR).

To configure the CIR and EIR of a Frame Relay DLCI, proceed as follows:

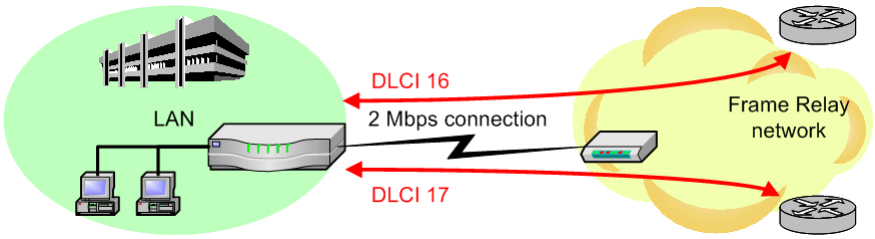
Step	Action
1	In the wanInterface/atm object, select the frAtm table and then select the frameRelay structure. 
2	In the frameRelay structure, configure the following elements:  • cir. Use this element to set the Committed Information Rate for the DLCI. The cir is expressed in bps. Enter a multiple of 64000 bps as cir value (e.g. 2048000). The maximum value is the physical connection towards the Frame Relay network. If the cir value is set to 0 (default), it means the complete bandwidth may be used (no flow control). • eir. Use this element to set the Excess Information Rate for the DLCI. The eir is expressed in bps. Enter a multiple of 64000 bps as eir value (e.g. 2048000). The maximum value is the physical connection towards the Frame Relay network. If the eir value is set to 0 (default), it means no excess burst is allowed. The bursts of data that are allowed are the CIR value + EIR value. I.e. If you want a CIR of 1 Mbps and you want to allow bursts up to 1.5 Mbps, then set the CIR to 1024000 bps and the EIR to 512000 bps.

Important remarks

- Be careful not to over-dimension the CIR. I.e. do not let the sum of the CIRs of the DLCIs exceed the bandwidth of the physical connection.
- When you do exceed the total bandwidth of the physical connection, then the Telindus 1431 SHDSL CPE first buffers the data. However, when the buffers of the Telindus 1431 SHDSL CPE are completely filled up, it has to discard the "excess" data.
- To obtain an optimal QoS for links that contain both voice and data DLCIs, it is advisable to use CIR for the voice DLCIs and EIR for the data DLCIs. This decreases the amount of data packets that are queued in a single burst, thereby reducing the transmission delay for voice packets.

Examples

Suppose you have a 2 Mbps physical connection towards the Frame Relay service provider and you define 2 DLCIs:



- Suppose you assign to both DLCIs a CIR of 1 Mbps and an EIR of 0.

  ⇒In that case you have per DLCI a guaranteed bandwidth of 1 Mbps and no bursts are allowed.

- Suppose you assign to both DLCIs a CIR of 512 kbps and an EIR of 512 kbps.

  ⇒In that case you have per DLCI a guaranteed bandwidth of 512 kbps and you allow bursts up to 1 Mbps. This means that if on both DLCIs a burst up to 1 Mbps occurs at the same time, the speed of the physical connection (2 Mbps) is still not exceeded (so no data is discarded). If however somewhere else on the network a congestion occurs, it is possible that some of the “excess” data is discarded (refer to What is DE? on page 159).

- Suppose you assign to both DLCIs a CIR of 1 Mbps and an EIR of 1 Mbps.

  ⇒In that case you have per DLCI a guaranteed bandwidth of 1 Mbps and you allow bursts up to 2 Mbps. Obviously, this means that if on both DLCIs a burst up to 2 Mbps occurs at the same time, the speed of the physical connection (2 Mbps) is exceeded and some data is discarded. In that case the principle of first come, first served is applied. I.e. the DLCI on which the burst occurred first its data is passed on to the Frame Relay network. If however somewhere else on the network a congestion occurs, it is still possible that some of the “excess” data is discarded.

- Suppose you assign to both DLCIs a CIR of 2 Mbps and an EIR of 0.

  ⇒In that case you over-dimensioned your CIR. You can not guarantee 2 Mbps of bandwidth for both DLCIs, due to the bandwidth limit of 2 Mbps on the physical connection. Also in this case the principle of first come, first served is applied. I.e. the DLCI which sends data first gets its data onto the Frame Relay network.

9.3 Configuring CES encapsulation

Whereas 7 - Configuring Circuit Emulation Service on page 117 explains the CES concept and how to set up the CES links, this section introduces the CES encapsulation protocol and gives a short description of the attributes you can use to configure this encapsulation protocol.

The following gives an overview of this section:

- 9.3.1 - Introducing CES encapsulation on page 165
- 9.3.2 - Configuring the cell variation and fill size on page 166

9.3.1 Introducing CES encapsulation

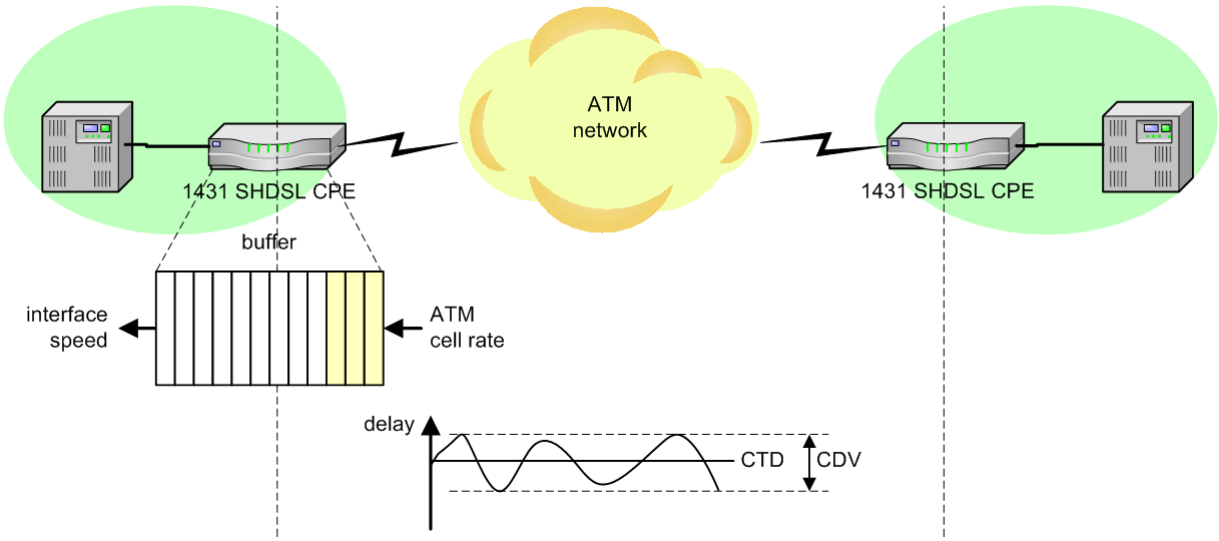
For an introduction on the CES concept, refer to 7.1 - Introducing Circuit Emulation Service (CES) on page 118.

What is CTD and CDV?

For real-time applications, particularly those involving voice and video, overall network delay is often critical. Delay introduced by the ATM network interconnecting two CES IWFs consists of two parameters:

- The Cell Transfer Delay (CTD) is the largest expected cell delay between entrance into and exit from the ATM network.
- The Cell Delay Variation (CDV) is the jitter or variation in the delay that might be experienced by any particular cell.

The reassembly process on the receive side of the ATM network needs a buffer in which the reassembled cell stream is stored before it is transmitted out the serial or E1 interface. In other words, CES hardware must have reassembly buffers large enough to accommodate the largest CDV present on a PVC to prevent underrun and overrun, yet not so large as to induce excessive overall delay.



What happens in case of a buffer underrun and overrun?

If you dimension the ATM cell buffer incorrectly, then a buffer underrun or overrun may occur. In case of a buffer …

- underrun, dummy cells are inserted. This can be the result of, for example, cell losses or cell discards.
- overrun, cells are discarded. Eventually, the CES link has to resynchronise. This can be the result of, for example, a too high ATM cell rate (filling the buffer) and a too low interface speed (emptying the buffer).

What is CDVT?

The Cell Delay Variation Tolerance (CDVT) is the maximum acceptable Cell Delay Variation (CDV).

9.3.2 Configuring the cell variation and fill size

As said before, overall network delay is often critical for real-time applications, particularly those involving voice and video. Refer to What is CTD and CDV? on page 165.

Therefore, several attributes are available which you can use to deal with network delay:

- the maxCellVariation. Use this attribute to absorb the Cell Delay Variation (CDV), also called jitter. Refer to telindus1431Router/<modularIf>/ces/maxCellVariation on page 435.
- the fillSize. Use this attribute to determine with how many bytes a cell is filled before it is sent. Refer to telindus1431Router/<modularIf>/ces/fillSize on page 435.
- the cdvtOptimisation. Use this attribute enable or disable the optimisation of the Cell Delay Variation Tolerance (CDVT). Refer to telindus1431Router/wanInterface/atm/ces/atm on page 421.

9.4 Configuring PPP encapsulation (in case of PPPo…)

When using PPP over ATM or PPP over Ethernet, it is possible that you have to configure some PPP related configuration attributes. Therefore, this section introduces the PPP encapsulation protocol and gives a short description of the attributes you can use to configure this encapsulation protocol.

The following gives an overview of this section:

- 9.4.1 - Introducing PPP on page 168
- 9.4.2 - Automatically obtaining IP addresses in PPP on page 171
- 9.4.3 - Configuring IP addresses in PPP on page 173
- 9.4.4 - Imposing IP addresses on the remote in PPP on page 174
- 9.4.5 - Configuring link monitoring on page 175
- 9.4.6 - Configuring PAP on page 176
- 9.4.7 - How does PAP work? on page 177
- 9.4.8 - Configuring CHAP on page 179
- 9.4.9 - How does CHAP work? on page 180
- 9.4.10 - Use which name and secret attributes for PPP authentication? on page 182

9.4.1 Introducing PPP

What is PPP?

The Point-to-Point Protocol (PPP) originally emerged as an encapsulation protocol for transporting IP traffic over point-to-point links. PPP also established a standard for assigning and managing IP addresses, asynchronous and bit-oriented synchronous encapsulation, network protocol multiplexing, link configuration, link quality testing, error detection, and option negotiation for added networking capabilities.

Also refer to What is PPPoA (RFC 2364)? on page 135.

What is LCP, IPCP, BCP and CCP?

PPP provides a method for transmitting datagrams over serial point-to-point links, which include the following components:

- A method for encapsulating datagrams over serial links.
- An extensible Link Control Protocol (LCP) which provides a method of establishing, configuring, maintaining, and terminating the point-to-point connection.
- A family of Network Control Protocols (NCPs) for establishing and configuring different network layer protocols such as the IP Control Protocol (IPCP) and the Bridge Control Protocol (BCP).
- A Compression Control Protocol (CCP) for configuring, enabling and disabling data compression algorithms on both ends of the point-to-point link.

The PPP handshake

PPP makes a handshake in two phases:

Phase	Description
1	The Link Control Protocol (LCP) builds the link layer.
2	The Network Control Protocol (NCP, i.e. IPCP or BCP) builds the network layer.

What is PPP link monitoring?

PPP features link monitoring in order to whether the PPP link is truly up or down. If link monitoring is enabled, then echo request packets are sent over the link at regular intervals. If on consecutive requests no reply is given, then the PPP link is declared down. Data traffic is stopped until the PPP handshake succeeds again.

What is PAP?

The Password Authentication Protocol (PAP) is the most basic form of authentication (complies with RF 1334). It basically works the same way as a normal login procedure. The peer (the authenticating system) authenticates itself by sending a username and password to the authenticator. The authenticator compares this username and password to its secrets database. If the password matches, the peer is authenticated and the session can be set up. PAP authentication can be performed in one direction or in both directions.

The disadvantage of PAP is that it is vulnerable to eavesdroppers who may try to obtain the password by listening in on the serial line, and to repeated trial and error attacks.

What is CHAP?

The Challenge Handshake Authentication Protocol (CHAP) is more secure than PAP.

With CHAP, the server (the authenticator) sends a randomly generated “challenge” string to the client (the authenticating system). The client hashes the challenge string, its username and password using the MD5 algorithm. This result is returned to the server. The server now performs the same computation and compares this username and password to its secrets database. If the passwords match, the client is authenticated and the session can be set up. CHAP authentication can be performed in one direction or in both directions.

Another feature of CHAP is that it does not only requires the client to authenticate itself at start-up time, but to do so at regular intervals. This to make sure the client has not been replaced by an intruder (for instance by just switching lines).

What is MS-CHAP?

The Microsoft Challenge Handshake Authentication Protocol (MS-CHAP) is the Microsoft version of CHAP and is an extension to RFC 1994. Like the standard version of CHAP, MS-CHAP is used for PPP authentication. In this case, authentication occurs between a PC using Microsoft Windows and a router or access server acting as a network access server (NAS).

The differences between the standard CHAP and MS-CHAP are:

- MS-CHAP is enabled by negotiating CHAP Algorithm 0x80 in LCP option 3, Authentication Protocol.
- The MS-CHAP Response packet is in a format designed to be compatible with Microsoft Windows. This format does not require the authenticator to store a clear or reversibly encrypted password.
- MS-CHAP provides an authenticator-controlled authentication retry mechanism.
- MS-CHAP provides an authenticator-controlled change password mechanism.
- MS-CHAP defines a set a "reason for failure" codes returned in the Failure packet message field.

What is MS-CHAP v2?

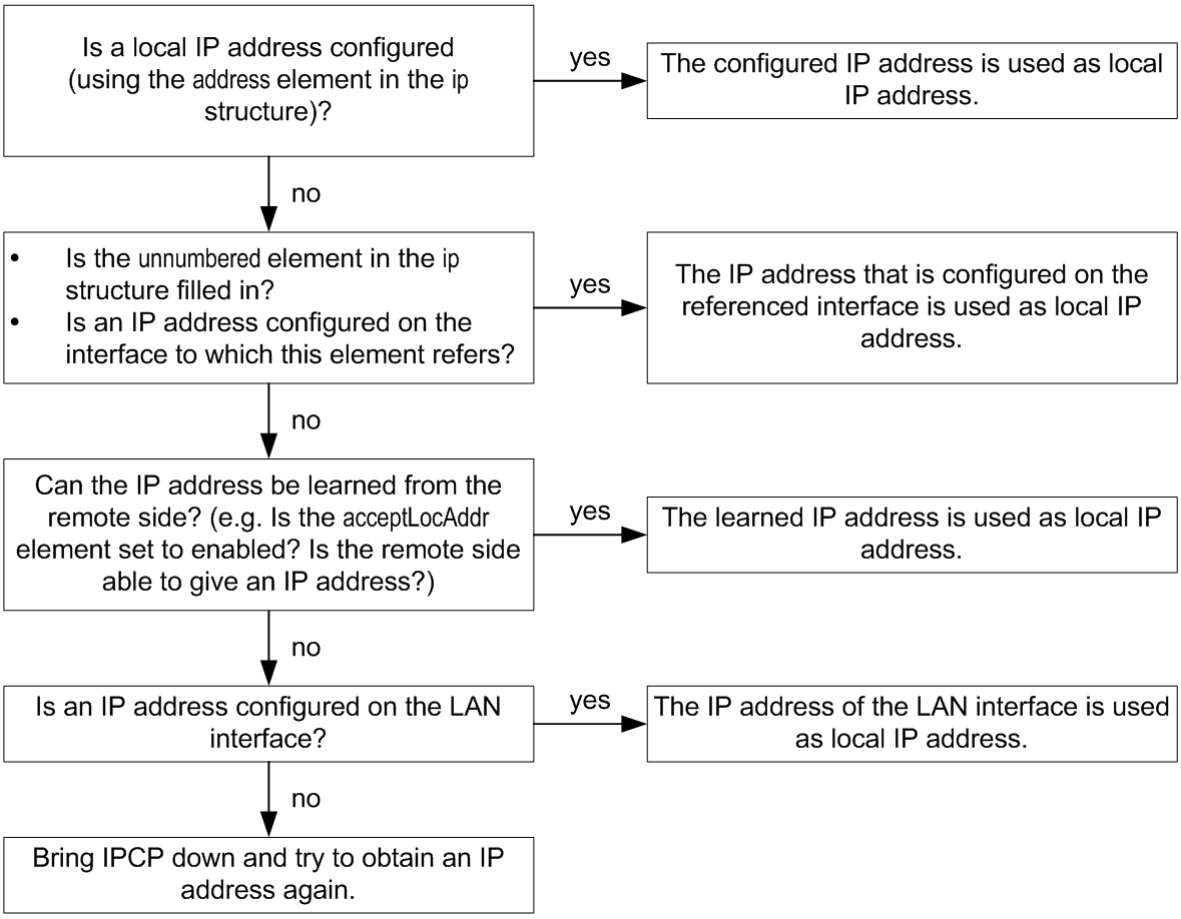
MS-CHAP version 2 provides stronger security for remote access connections and also solves some issues of MS-CHAP version 1:

MS-CHAP version 1 issue	MS-CHAP version 2 solution
LAN Manager encoding of the response used for backward compatibility with older Microsoft remote access clients is cryptographically weak.	MS-CHAP v2 no longer allows LAN Manager encoded responses.
LAN Manager encoding of password changes is cryptographically weak.	MS-CHAP v2 no longer allows LAN Manager encoded password changes.
Only one-way authentication is possible. The remote access client cannot verify that it is dialling in to its organisation's remote access server or a masquerading remote access server.	MS-CHAP v2 provides two-way authentication, also known as mutual authentication. The remote access client receives verification that the remote access server that it is dialling in to has access to the user's password.
With 40-bit encryption, the cryptographic key is based on the user's password. Each time the user connects with the same password, the same cryptographic key is generated.	With MS-CHAP v2, the cryptographic key is always based on the user's password and an arbitrary challenge string. Each time the user connects with the same password, a different cryptographic key is used.
A single cryptographic key is used for data sent in both directions on the connection.	With MS-CHAP v2, separate cryptographic keys are generated for transmitted and received data.

9.4.2 Automatically obtaining IP addresses in PPP

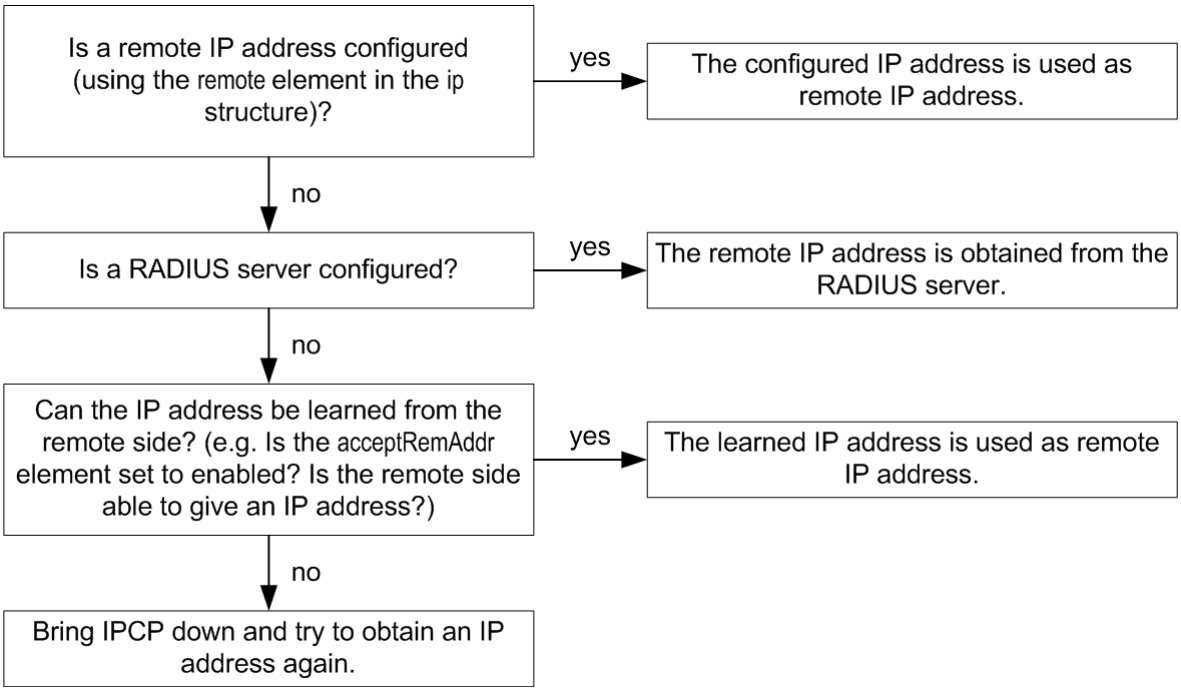
Obtaining a local IP address

In case of PPP, the Telindus 1431 SHDSL CPE can learn the local IP address of a PPP link.


Is a local IP address configured (using the address element in the ip structure)?
yes
The configured IP address is used as local IP address.
no
Is the unnumbered element in the ip structure filled in?
Is an IP address configured on the interface to which this element refers?
yes
The IP address that is configured on the referenced interface is used as local IP address.
no
Can the IP address be learned from the remote side? (e.g. Is the acceptLocAddr element set to enabled? Is the remote side able to give an IP address?)
yes
The learned IP address is used as local IP address.
no
Is an IP address configured on the LAN interface?
yes
The IP address of the LAN interface is used as local IP address.
no
Bring IPCP down and try to obtain an IP address again.

Obtaining a remote IP address

In case of PPP, the Telindus 1431 SHDSL CPE can learn the remote IP address of a PPP link.


Is a remote IP address configured (using the remote element in the ip structure)?
yes
The configured IP address is used as remote IP address.
no
Is a RADIUS server configured?
yes
The remote IP address is obtained from the RADIUS server.
no
Can the IP address be learned from the remote side? (e.g. Is the acceptRemAddr element set to enabled? Is the remote side able to give an IP address?)
yes
The learned IP address is used as remote IP address.
no
Bring IPCP down and try to obtain an IP address again.

9.4.3 Configuring IP addresses in PPP

To configure IP addresses on a PPP(oA) link, proceed as follows:

Step	Action
1	In case you set up a … • PPPoA link on the WAN interface, then you actually configure the IP addresses on ATM PVC level. So in that case, you have to configure the IP related parameters the ip structure of the pvcTable. **PPPoA link on WAN** In the atm object, select the pvcTable and then select the ip structure.
2	In the ip structure, configure the following elements: • address. Use this element to assign an IP address to the local end of the PPP(oA) link. • netMask. Use this element to assign an IP subnet mask to the local end of the PPP(oA) link. • remote. Use this element to assign an IP address to the remote end of the PPP(oA) link. • unnumbered. In case you do not explicitly configure a local IP address for an PPP(oA) link, then you can use this element to "borrow" the IP address of another interface for which an IP address is already configured. • acceptLocAddr. Use this element to determine whether to accept or reject the local IP address being imposed by the remote side. • acceptRemAddr. Use this element to determine whether to accept or reject the remote IP address being imposed by the remote side. Refer to 5.2.3 - Explaining the ip structure on page 60 for a complete description of the ip structure.

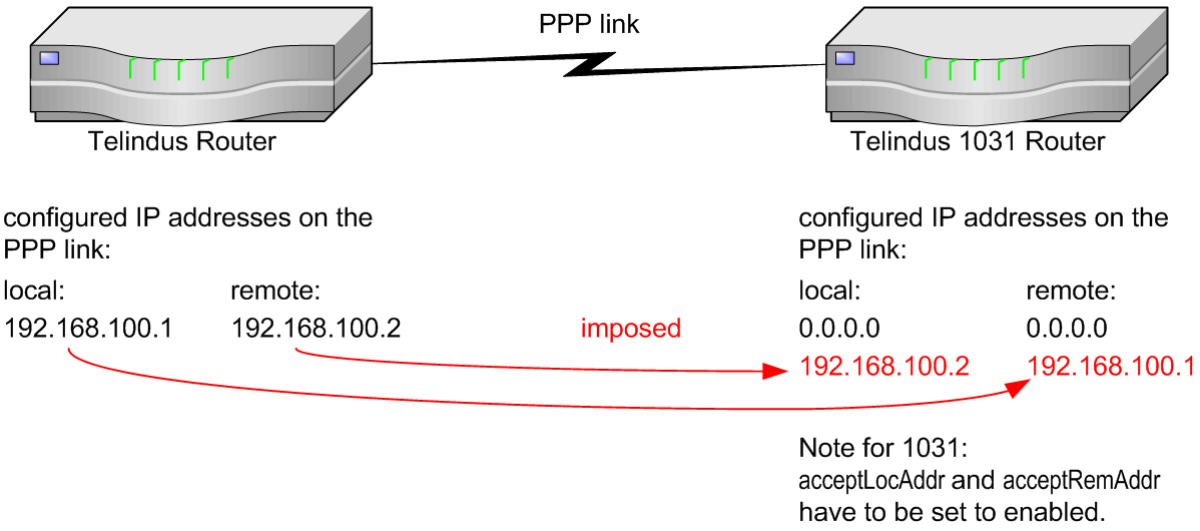
9.4.4 Imposing IP addresses on the remote in PPP

As can be seen in 9.4.2 - Automatically obtaining IP addresses in PPP on page 171, in case of PPP the Telindus 1431 SHDSL CPE can learn IP addresses from the remote side. What is more, in case of PPP the Telindus 1431 SHDSL CPE itself can impose IP addresses on the remote.

To impose IP addresses on the remote, proceed as follows:

Step	Action
1	On the Telindus 1431 SHDSL CPE, configure a local and remote IP address on the PPP link. Refer to 9.4.3 - Configuring IP addresses in PPP on page 173.
2	On the remote device (e.g. a Telindus 1031 Router), configure nor a local nor a remote address on the PPP link. ⇒Once the PPP handshake reaches the IPCP stage, the Telindus 1031 Router will declare to the Telindus 1431 SHDSL CPE that it has no IP addresses on its PPP link. The Telindus 1431 SHDSL CPE on its turn will impose the local and remote IP address of the PPP link on the Telindus 1031 Router. ⇒What is more, the Telindus 1031 Router adds a route towards the Telindus 1431 SHDSL CPE. Also see the explanation of the element gatewayPreference on page 62. Note that the IP configuration attributes acceptLocAddr and acceptRemAddr on the Telindus 1031 Router have to be set to enabled. Else the Telindus 1031 Router will not accept the IP addresses imposed by the Telindus 1431 SHDSL CPE.

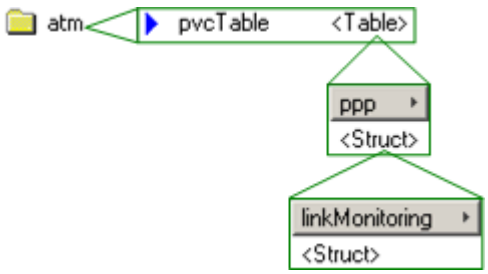
Example - imposing IP addresses on the remote in PPP



9.4.5 Configuring link monitoring

Refer to 9.4.1 - Introducing PPP on page 168 for an introduction on link monitoring.

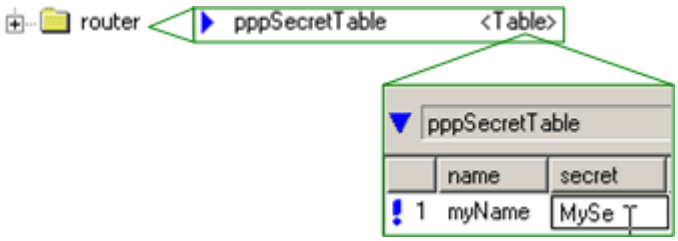
To configure link monitoring on a PPP(oA) link, proceed as follows:

Step	Action
1	**PPPoA link on WAN** In the atm object, select the pvcTable and then select the linkMonitoring structure. 
2	The linkMonitoring structure contains the following elements: • operation. Use this element to enable or disable link monitoring. • interval. Use this element to set the time interval between two consecutive echo requests. • replyTimeOut. Use this element to set the time the Telindus 1431 SHDSL CPE waits for a reply on the echo request. • failsPermitted. Use this element to set the number of echo requests that may fail before the Telindus 1431 SHDSL CPE declares the PPP link down. Refer to telindus1431Router/wanInterface/atm/pvcTable/ppp/linkMonitoring on page 440 for a complete description of the linkMonitoring structure.

9.4.6 Configuring PAP

Refer to 9.4.1 - Introducing PPP on page 168 for an introduction on PAP.

To configure PAP on a PPP(oA) link, proceed as follows:

Step	Action
1	On the authenticating router, configure the PPP attributes authentication and authenPeriod. • authentication. Use this attribute to set the PPP authentication to PAP. • authenPeriod. Use this attribute to determine the interval at which the PPP link is authenticated once it has been set up. Refer to 14.5.4 - PPPoA configuration attributes on page 438 for a detailed description of the ppp attributes.
2	On the peer router, configure the following attributes: • sysName. Use this attribute to set the name of the peer. This is used in the authentication process. Alternatively, you can use the sessionName attribute. Refer to 9.4.10 - Use which name and secret attributes for PPP authentication? on page 182 for more information on what to use. • sysSecret. Use this attribute to set the secret of the peer. This is used in the authentication process. Alternatively, you can use the sessionSecret attribute. Refer to 9.4.10 - Use which name and secret attributes for PPP authentication? on page 182 for more information on what to use.
3	Again on the authenticating router, go to the router object and configure the pppSecretTable. In this table, enter the name and secret you configured on the peer in step 2. These are used in the authentication process. 

How exactly all these configuration attributes are used in the authentication process is explained in the 9.4.7 - How does PAP work? on page 177.

9.4.7 How does PAP work?

Refer to 9.4.1 - Introducing PPP on page 168 for an introduction on PAP.

PAP authentication in one direction

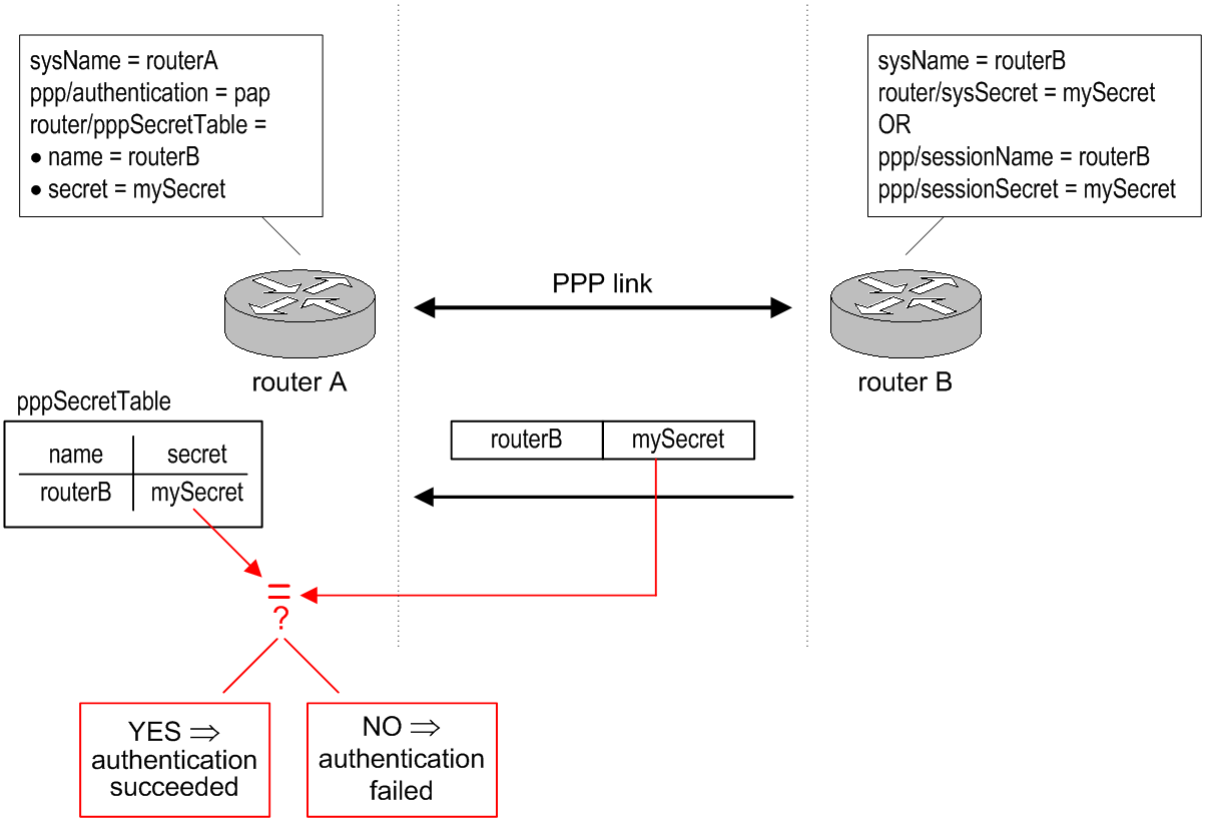
The router authenticates after building its LCP layer and prior to building the IPCP layer. If the authentication succeeds, then the PPP link is built further until data can be sent. Else PPP starts its handshake again.

Consider the following example: router A (the Telindus 1431 SHDSL CPE) is the authenticator and router B is the peer. Router A is configured for PAP authentication and router B is not. The authentication process goes as follows:

Phase	Description
1	Router B wants to establish a PPP link with router A (the Telindus 1431 SHDSL CPE).
2	Router A asks router B to authenticate himself.
3	Router B sends its name[1] and its secret[2] to router A.
4	Router A looks up the name of router B in its pppSecretTable to find a corresponding secret. If the secret found in the pppSecretTable matches the secret received from router B, then the authentication succeeded and a PPP link is established. Else the authentication failed and no PPP link is established.

1. Depending on how router B is configured, this can be its sysName or sessionName.
2. Depending on how router B is configured, this can be its sysSecret or sessionSecret.

The following figure shows the PAP authentication process:



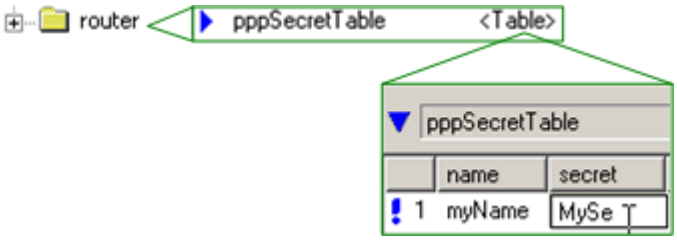
PAP authentication in both directions

If PAP authentication is enabled on both routers, then they both request and respond to the authentication. If the remote router is a router from another vendor, then read the documentation in order to find out how to configure the PAP name and secret values.

9.4.8 Configuring CHAP

Refer to 9.4.1 - Introducing PPP on page 168 for an introduction on CHAP.

To configure CHAP on a PPP(oA) link, proceed as follows:

Step	Action
1	On the authenticating router, configure the PPP attributes authentication and authenPeriod. • authentication. Use this element to set the PPP authentication to CHAP (or MS-CHAP or MS-CHAP v2). • authenPeriod. Use this attribute to determine the interval at which the PPP link is authenticated once it has been set up. Refer to 14.5.4 - PPPoA configuration attributes on page 438 for a detailed description of the ppp attributes.
2	On the peer router, configure the following attributes: • sysName. Use this attribute to set the name of the peer. This is used in the authentication process. Alternatively, you can use the sessionName attribute. Refer to 9.4.10 - Use which name and secret attributes for PPP authentication? on page 182 for more information on what to use. • sysSecret. Use this attribute to set the secret of the peer. This is used in the authentication process. Alternatively, you can use the sessionSecret attribute. Refer to 9.4.10 - Use which name and secret attributes for PPP authentication? on page 182 for more information on what to use.
3	Again on the authenticating router, go to the router object and configure the pppSecretTable. In this table, enter the name and secret you configured on the peer in step 2. These are used in the authentication process. 

How exactly all these configuration attributes are used in the authentication process is explained in the 9.4.9 - How does CHAP work? on page 180.

9.4.9 How does CHAP work?

Refer to 9.4.1 - Introducing PPP on page 168 for an introduction on CHAP.

CHAP authentication in one direction

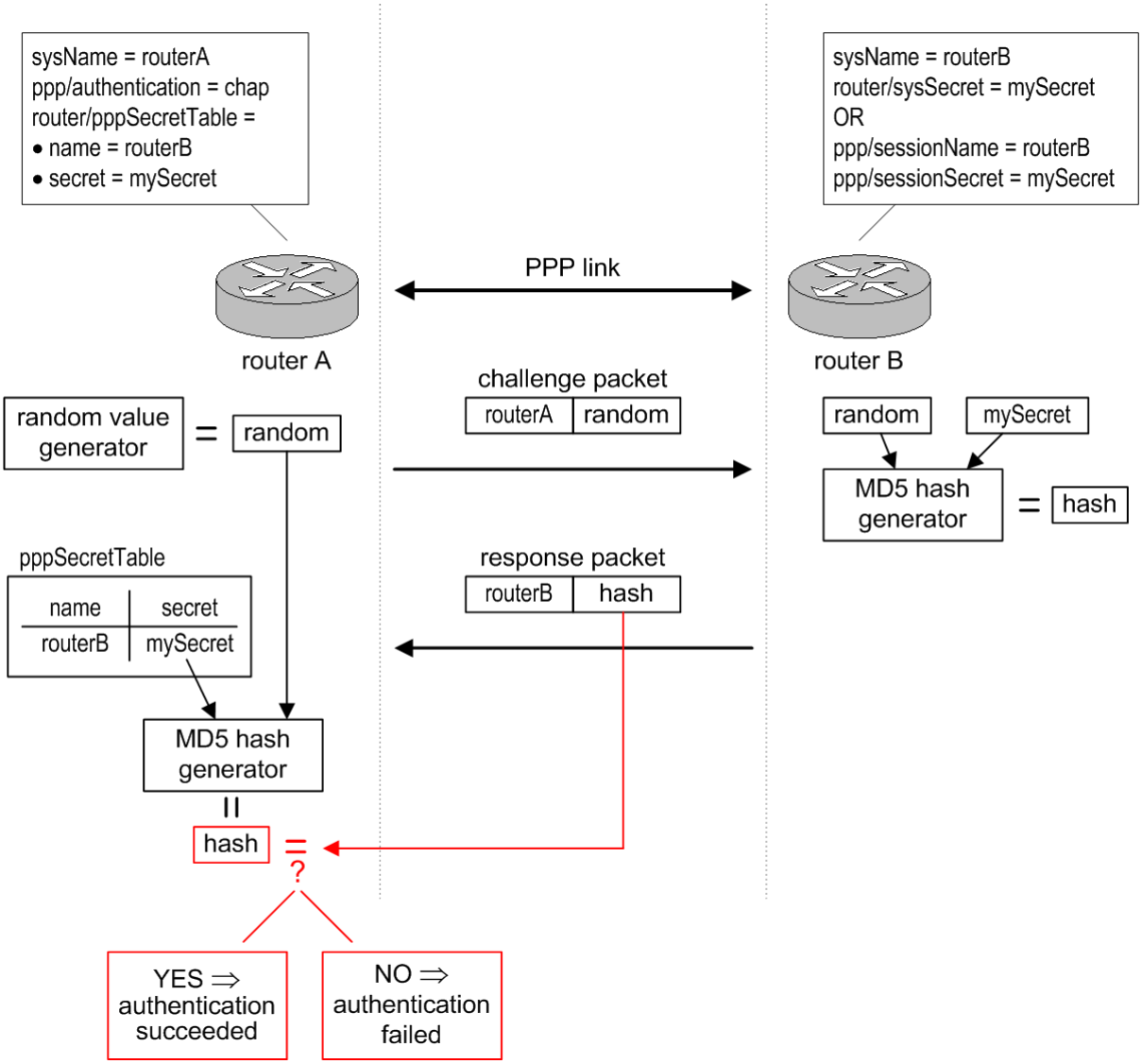
The router authenticates after building its LCP layer and prior to building the IPCP layer. If the authentication succeeds, then the PPP link is built further until data can be sent. Else PPP starts its handshake again.

Consider the following example: router A (the Telindus 1431 SHDSL CPE) is the authenticator and router B is the peer. Router A is configured for CHAP authentication and router B is not. The authentication process goes as follows:

Phase	Description
1	Router B wants to establish a PPP link with router A (the Telindus 1431 SHDSL CPE).
2	Router A asks router B to authenticate himself. So router A sends a challenge packet containing a random value to router B. The challenge packet also contains the sysName of router A. If the peer (router B) is also a Telindus Router, then it does nothing with it. Other vendors, however, may use this sysName to determine which secret to use in the authentication process. Check the vendor's documentation.
3	Router B feeds the random value and its secret[1] into the MD5 hash generator, resulting in a hash value.
4	Router B sends a response packet containing the hash value and its name[2].
5	Router A looks up the name of router B in its pppSecretTable to find a corresponding secret. This secret found in the pppSecretTable and the random value router A sent in step 2 is fed into the MD5 hash generator, resulting in a hash value. If this hash value equals the hash value received from router B, then the authentication succeeded and a PPP link is established. Else the authentication failed and no PPP link is established.

1. Depending on how router B is configured, this can be its sysSecret or sessionSecret.
2. Depending on how router B is configured, this can be its sysName or sessionName.

The following figure shows the authentication process:



CHAP authentication in both directions

If CHAP authentication is enabled on both routers, then they both request and respond to the authentication. If the remote router is a router from another vendor, then read the documentation in order to find out how to configure the CHAP name and secret values.

9.4.10 Use which name and secret attributes for PPP authentication?

Older firmware versions only used the sysName and the router/sysSecret attributes in their PPP authentication process. Newer firmware versions, however, have two new attributes for PPP authentication purposes being: ppp/sessionName and ppp/sessionSecret. This enhancement allows you to define different names and secrets for each PPP link (whereas before all PPP links used the same sysName and sysSecret attribute).

So suppose you have several ATM PVCs on which you all run PPPoA, you can use a different name and secret for each PPPoA link by configuring per PVC the sessionName and sessionSecret in the ppp structure of the atm/pvcTable attribute.

Refer to …

- telindus1431Router/sysName on page 387
- telindus1431Router/router/sysSecret on page 475
- telindus1431Router/wanInterface/atm/pvcTable/ppp/sessionName on page 442
- telindus1431Router/wanInterface/atm/pvcTable/ppp/sessionSecret on page 442

Important remarks

- If on a PPP link authentication is enabled and the sessionName/sessionSecret attributes are *not* filled in, then the sysName/sysSecret attributes are used in the PPP authentication process for that link.
- If on a PPP link authentication is enabled and the sessionName/sessionSecret attributes are filled in, then the sysName/sysSecret attributes are ignored and are *not* used in the PPP authentication process for that link.
- If you have several PPP links and you use a different name and secret for each link (using the sessionName/sessionSecret attributes), then do not forget to add all these names and secrets in the pppSecretTable of the authenticator.
- The sysName/sysSecret attributes do not serve as “back-up” for the sessionName/sessionSecret attributes. This means that if for some reason authentication using the sessionName/sessionSecret attributes fails (e.g. because the secrets do not match), then the authenticator *does not* restart the authentication process using the sysName/sysSecret attributes instead.
- If you have several PPP links, it is allowed to use a specific name and secret on some of them (using the sessionName/sessionSecret attributes) and use a general name and secret for the rest (using the sysName/sysSecret attributes). In that case, make sure that for the latter the sessionName/sessionSecret attributes are *not* configured (i.e. their value fields are empty).

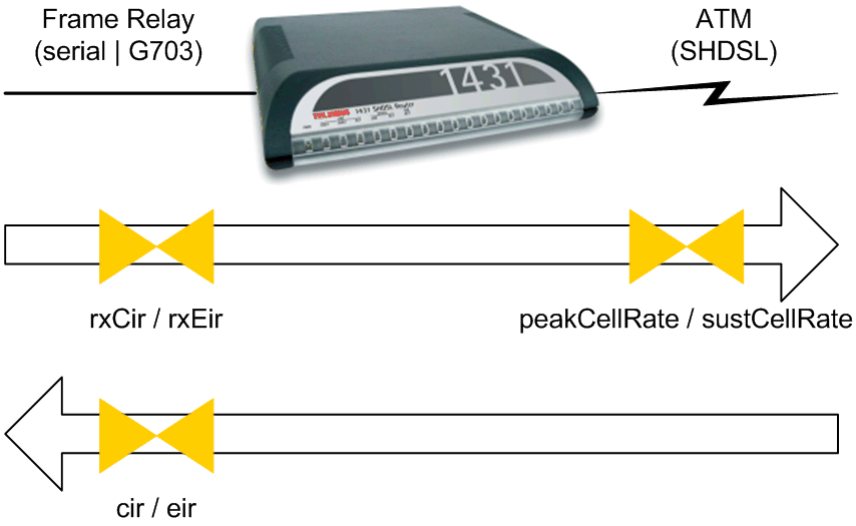
9.5 Bandwidth control on Telindus 1431 SHDSL CPE

This section shows you on which different levels you can control the bandwidth on the Telindus 1431 SHDSL CPE and this for the different modes of operation (FRF, CES and ATM over E1).

The following gives an overview of this section:

- 9.5.1 - Bandwidth control in case of FRF on page 184
- 9.5.2 - Bandwidth control in case of CES on page 186
- 9.5.3 - Bandwidth control in case of ATM over E1 on page 186

9.5.1 Bandwidth control in case of FRF



As seen in the figure above, in case of FRF the bandwidth can be controlled in both directions and possibly on two levels:

- from DTE to network: bandwidth control on Frame Relay level and on ATM level.
- from network to DTE: bandwidth control on Frame Relay level.

From DTE to network

The bandwidth can be controlled on the Frame Relay data received from the serial or G703 interface. The configuration attributes rxCir, rxEir and rxExcess can be set per DLCI (refer to telindus1431Router/wanInterface/atm/frAtm on page 417). If the received bandwidth is …

- lower than the configured rxCir, then all frames are passed.
- between the configured rxCir and rxCir+rxEir, then the behaviour depends on the configuration of rxExcess. If rxExcess is set to …
  - discard, then all frames in excess are dropped.
  - ignore, then all frames are passed.
  - setDeBit, then all frames are passed, but for the frames in excess the DE bit is set.
- higher than the configured rxCir+rxEir, all frames are dropped.

The rxCir and rxEir values are integers in bps units. So these parameters have a fine granularity.

The bandwidth can also be controlled on ATM level. The configuration attributes peakCellRate, sustCellRate and maxBurstSize can be set per PVC (refer to telindus1431Router/wanInterface/atm/frAtm on page 417). The peakCellRate and sustCellRate values are enumerated values between 64kbps and 2048kbps in steps of 64kbps. So these parameters have less granularity. Note that these values also include the ATM overhead.

Since the granularity of bandwidth control on Frame Relay level is better than on ATM level and since for the FRF service bandwidth requirements are on Frame Relay level, it is recommended to control the bandwidth on Frame Relay level. In this case the ATM peakCellRate can be set to auto (i.e. no bandwidth limitation). However, if the ATM network checks on service class parameters with PCR values not being 64 kbps multiples, you could configure the peakCellRate to a 64 kbps multiple just below the PCR value of the network in order to avoid losing packets in the next ATM switch.

From network to DTE

The bandwidth can be controlled on the Frame Relay data received from the network. The configuration attributes cir, eir and deBitSet can be set per DLCI (refer to telindus1431Router/wanInterface/atm/frAtm on page 417). If the received bandwidth is …

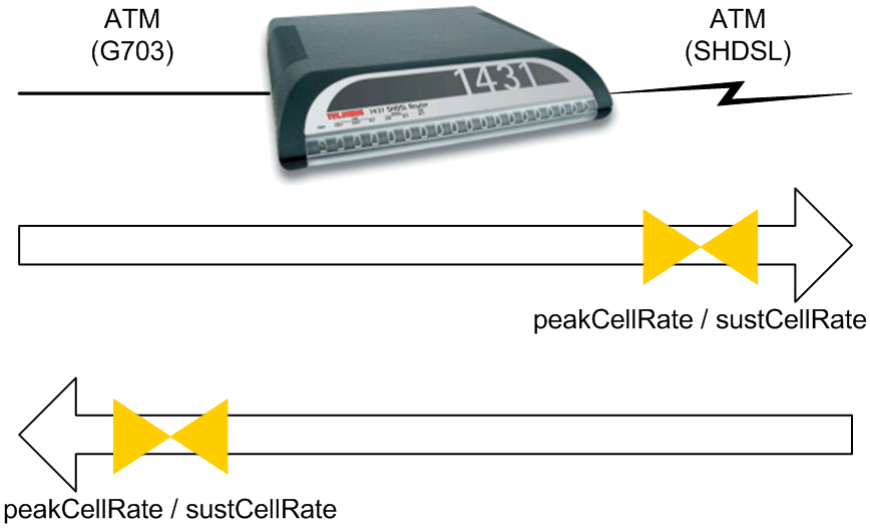
- lower than the configured cir, then all frames are passed.
- between the configured cir and cir+eir, then the behaviour depends on the configuration of deBitSet. If deBitSet is set to …
  - enabled, then all frames are passed, but for the frames in excess the DE bit is set.
  - disabled, then all frames are passed without any modification.
- higher than the configured cir+eir, then all frames are dropped.

The cir and eir values are enumerated values between 64kbps and 2048kbps in steps of 64kbps.

9.5.2 Bandwidth control in case of CES

In case of CES, the ATM service category is Constant Bit Rate (CBR). The bandwidth is determined by the speed on the serial or G703 interface towards the DTE. Possible speeds are multiples of 64kbps up to 2048kbps (4096kbps on 2 pair version). The ATM CBR parameters adapt to this speed (including the ATM cell overhead). No further bandwidth configuration is applicable.

9.5.3 Bandwidth control in case of ATM over E1



In case of ATM over E1, the bandwidth can be controlled both on the SHDSL line interface and on the E1 interface for the outgoing traffic. The configuration attributes peakCellRate, sustCellRate and maxBurstSize can be set per PVC. The peakCellRate and sustCellRate values are enumerated values between 64kbps and 2048kbps in steps of 64kbps. So these parameters have less granularity. Note that these values also include the ATM overhead.

10 Configuring routing

This chapter introduces routing on the Telindus 1431 SHDSL CPE and lists the attributes you can use to configure routing. It also introduces the most important features of the router besides routing and lists the attributes you can use to configure these features.

The following gives an overview of this chapter:

- 10.1 - Introducing routing on page 188
- 10.2 - Enabling routing on an interface on page 189
- 10.3 - Configuring static routes on page 190
- 10.4 - Configuring policy based routing on page 198
- 10.5 - Configuring RIP on page 203
- 10.6 - Configuring OSPF on page 211
- 10.7 - Configuring address translation on page 220
- 10.8 - Configuring traffic and priority policy on the router on page 238
- 10.9 - Configuring VRRP on page 253

Refer to the Reference manual on page 377 for a complete overview of the attributes of the Telindus 1431 SHDSL CPE.

10.1 Introducing routing

What is routing?

Routing is the act of moving information across an internetwork from a source to a destination.

Routing versus bridging

Routing is often contrasted with bridging. At first sight, bridging might seem to do the same as routing. The primary difference between the two is that bridging occurs at layer 2 (the link layer) of the OSI reference model, whereas routing occurs at Layer 3 (the network layer). In other words, bridging occurs at a lower level and is therefore more of a hardware function whereas routing occurs at a higher level where the software component is more important. And because routing occurs at a higher level, it can perform more complex analysis to determine the optimal path for the packet.

Basic routing activities

Routing involves two basic activities:

- determining optimal routing paths,
- transporting information groups (typically called packets).

Determining the optimal routing path

In order to determine a routing path, routers initialise and maintain routing tables. These routing tables contain a variety of information. For example:

- Destination/next hop associations tell a router that a particular destination can be reached optimally by sending the packet to a particular router representing the "next hop" on the way to the final destination. When a router receives an incoming packet, it checks the destination address and attempts to associate this address with a next hop.
- Desirability of a path. Routers use metrics to evaluate what path will be the best for a packet to travel.

Routers communicate with one another and maintain their routing tables through the transmission of a variety of messages. The routing update message is one such message that generally consists of all or a portion of a routing table. By analysing routing updates from all other routers, a router can build a detailed picture of network topology.

Transporting packets

In most cases, a host determines that it must send a packet to another host. Having acquired a router's address by some means, the source host sends a packet addressed specifically to a router's physical (i.e. Media Access Control or MAC) address, this time with the protocol (i.e. network) address of the destination host.

As it examines the packet's destination protocol address, the router determines that it either knows or does not know how to forward the packet to the next hop. If the router does not know how to forward the packet, it typically drops the packet. If the router knows how to forward the packet, however, it changes the destination physical address to that of the next hop and transmits the packet.

The next hop may be the ultimate destination host. If not, the next hop is usually another router, which executes the same switching decision process. As the packet moves through the internetwork, its physical address changes, but its protocol address remains constant.

10.2 Enabling routing on an interface

Refer to 10.1 - Introducing routing on page 188 for an introduction.

Per IP interface you can determine whether you perform routing, bridging or both. The following table shows, for each IP interface, how to enable routing on this interface:

Interface	How to enable routing?
LAN interface	Set the mode attribute to routing or routingAndBridging. The mode attribute can be found in the lanInterface object: telindus1431Router/lanInterface/mode. **Important remark** If you set the configuration attribute telindus1431Router/lanInterface/mode to bridging, then the settings of the configuration attribute telindus1431Router/lanInterface/ip are ignored. As a result, if you want to manage the Telindus 1431 SHDSL CPE via IP, you have to configure an IP address in the bridgeGroup object instead: telindus1431Router/bridge/bridgeGroup/ip.
VLAN on the LAN interface	Set the mode element to routing or routingAndBridging. The mode element can be found in the vlan table which is located in the lanInterface object: telindus1431Router/lanInterface/vlan/mode.
ATM PVC	Set the mode element to routing or routingAndBridging. The mode element can be found in the pvcTable table which is located in the atm object: telindus1431Router/wanInterface/atm/pvcTable/mode.
L2TP tunnel	Set the mode element to routing or routingAndBridging. The mode element can be found in the l2tpTunnels table which is located in the tunnels object: telindus1431Router/router/tunnels/l2tpTunnels/mode.
IPSEC L2TP tunnel	Set the mode element to routing or routingAndBridging. The mode element can be found in the ipsecL2tpTunnels table which is located in the tunnels object: telindus1431Router/router/tunnels/ipsecL2tpTunnels/mode.

10.3 Configuring static routes

This section introduces static routing and gives a short description of the attributes you can use to configure static routing.

The following gives an overview of this section:

- 10.3.1 - Introducing static routing on page 191
- 10.3.2 - Configuring a default route on page 192
- 10.3.3 - Configuring the routing table on page 193
- 10.3.4 - Configuring the routing table - rules of thumb on page 196
- 10.3.5 - The rerouting principle on page 197

10.3.1 Introducing static routing

Static versus dynamic routing

The following table states the differences between static and dynamic routing:

Routing algorithm	Description
static	Static routing algorithms are hardly algorithms at all, but are table mappings established by the network administrator before the beginning of routing. These mappings do not change unless the network administrator alters them. Static routing algorithms work well in environments where network traffic is relatively predictable and where network design is relatively simple.
dynamic	Because static routing systems cannot react to network changes, they generally are considered unsuitable for today's large, constantly changing networks. Most of the dominant routing algorithms today are dynamic routing algorithms, which adjust to changing network circumstances by analysing incoming routing update messages. If the message indicates that a network change has occurred, the routing software recalculates routes and sends out new routing update messages. These messages permeate the network, stimulating routers to rerun their algorithms and change their routing tables accordingly. Also refer to … • 10.5.1 - Introducing RIP on page 204. • 10.6.1 - Introducing OSPF on page 212.
static and dynamic	Dynamic routing algorithms can be supplemented with static routes where appropriate. A router of last resort (a router to which all unroutable packets are sent), for example, can be designated to act as a repository for all unroutable packets, ensuring that all messages are at least handled in some way.

What is a default route?

A default route is a route (also called gateway) that is used to direct packets addressed to networks not explicitly listed in the routing table. A default route is also typically used when only one specific remote network has to be reached.

What is a routing table?

The routing table is composed of a set of routes that are known to the router. It includes a list of known addresses, as well as information to get a packet one router closer to its final destination. Routing tables can be static (with routes manually entered by the network administrator) or dynamic (where routers communicate to exchange connection and route information using e.g. RIP).

10.3.2 Configuring a default route

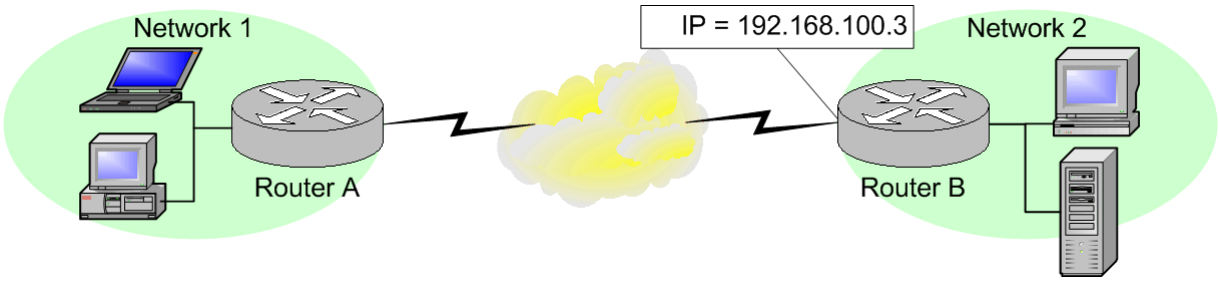
Refer to 10.3.1 - Introducing static routing on page 191 for an introduction on the default route.

To configure a default route, proceed as follows:

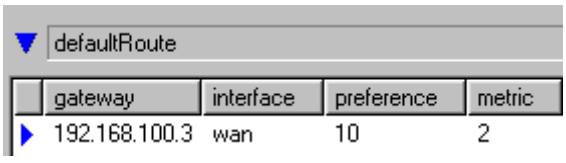
Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and select the defaultRoute attribute.
2	Configure the elements in the defaultRoute structure. The most important elements are: • gateway. Use this element to specify the IP address of the next router that will route all packets for which no specific (static or dynamic) route exists in the routing table. • interface. Use this element to specify the interface through which the gateway can be reached. Do this by typing the name of the interface as you assigned it using the configuration attribute name (e.g. telindus1431Router/lanInterface/name). Note that this interface can also be a DLCI, PVC, tunnel, etc. Refer to telindus1431Router/router/defaultRoute on page 470 for more information on.

Example - configuring a default route

Suppose network 1 is connected over a network of an operator to network 2. Network 1 only needs to reach network 2. So for the router in network 1 it suffices to configure a default route towards network 2.



Configure the defaultRoute attribute of Router A as follows:



10.3.3 Configuring the routing table

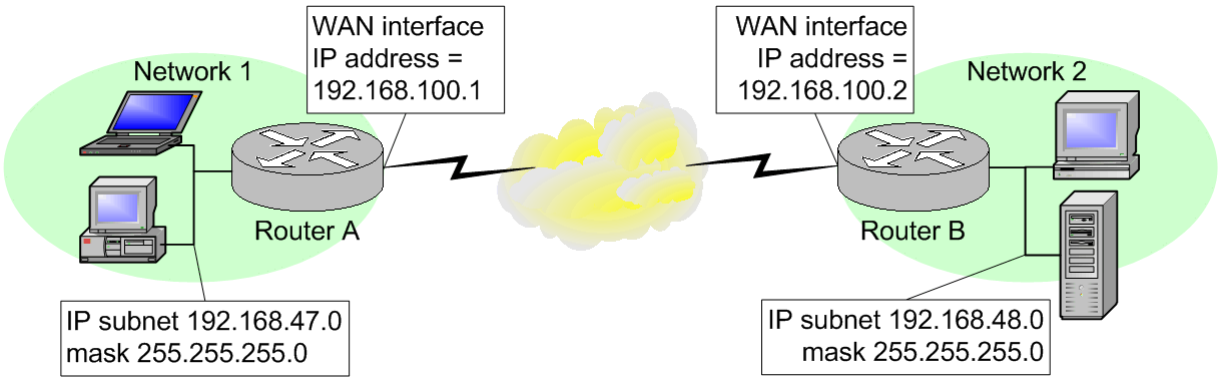
Refer to 10.3.1 - Introducing static routing on page 191 for an introduction on the routing table.

To configure the routing table, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and select the routingTable attribute.
2	Configure the elements in the routingTable: • network. Use this element to specify the IP address of the destination network. • mask. Use this element to specify the network mask of the destination network. • gateway. Use this element to specify the IP address of the next router on the path to the destination network. • interface. Use this element to specify the interface through which the destination network can be reached. Do this by typing the name of the interface as you assigned it using the configuration attribute name (e.g. telindus1431Router/lanInterface/name). Note that the “interface” can also be a DLCI, PVC, tunnel, etc. • preference. Use this element to set the level of importance of the route. • metric. Use this element to set with how much the metric parameter of a route has to be incremented. Refer to telindus1431Router/router/routingTable on page 471 for more information.

Example - configuring a static route (WAN IP address is present)

Suppose network 1 is connected over a network of an operator to network 2. The two routers have an IP address on their WAN interface.



To make network 192.168.48.0 reachable from network 192.168.47.0 and vice versa, you have to define one static route in Router A and one static route in Router B. So configure the routingTable attribute of Router A and B as follows:

Router A :

routingTable

	network	mask	gateway	interface	preference	metric
1	192.168.48.0	255.255.255.0	192.168.100.2		10	2

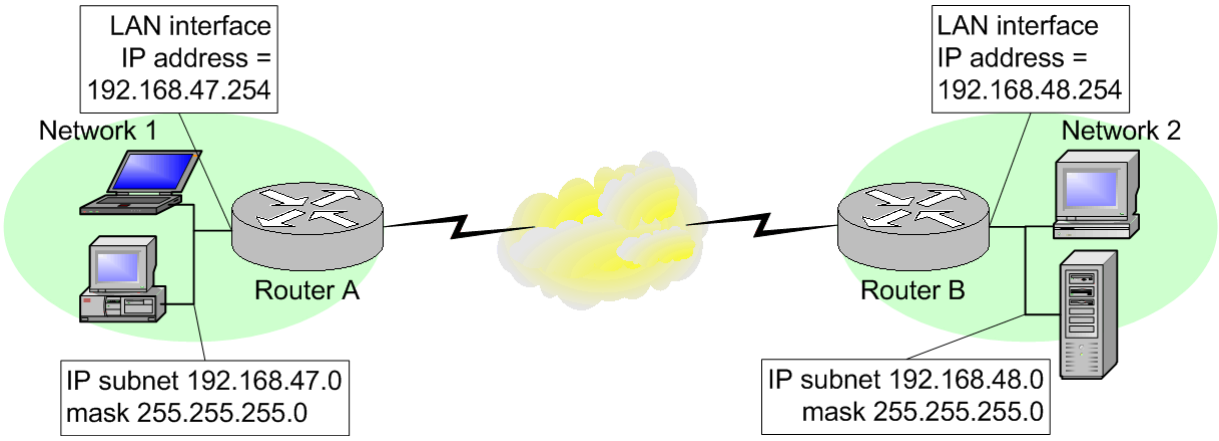
Router B :

routingTable

	network	mask	gateway	interface	preference	metric
1	192.168.47.0	255.255.255.0	192.168.100.1		10	2

Example - configuring a static route (WAN IP address is not present)

Suppose network 1 is connected over a network of an operator to network 2. The two routers do not have an IP address on their WAN interface, only on their LAN interface.



To make network 192.168.48.0 reachable from network 192.168.47.0 and vice versa, you have to define one static route in Router A and one static route in Router B. So configure the routingTable attribute of Router A and B as follows:

Router A :

routingTable

	network	mask	gateway	interface	preference	metric
1	192.168.48.0	255.255.255.0	192.168.48.254	wan	10	2

Router B :

routingTable

	network	mask	gateway	interface	preference	metric
1	192.168.47.0	255.255.255.0	192.168.47.254	wan	10	2

10.3.4 Configuring the routing table - rules of thumb

The following table lists some rules when configuring the routingTable:

Rule	Description
1	As a rule of thumb, one can say that the interface name has priority over the gateway.
2	In case you enter a correct (i.e. existing) interface name and in case it refers to a … • point-to-point (PTP) interface, the route is always added to the routing table, no matter which gateway (GW) is specified. • multi-point (MP) interface, then … - the route is only added to the routing table when a local gateway is specified. - the route is not added to the routing table when no gateway is specified. - a reroute occurs when no local gateway is specified.
3	In case you enter an incorrect interface name, the route is not added to the routing table.
4	In case you enter no interface name then … • the route is added to the routing table when a local gateway is specified. • the route is not added to the routing table when no gateway is specified. • the route is not added to the routing table when the gateway lies within the configured network route. For example: network = 10.0.0.0; mask = 255.255.255.0; gateway = 10.0.0.1. • a reroute occurs when no local gateway is specified.

The following table summarises the above:

Interface name	Gateway	Result
correct	none (0.0.0.0)	• PTP: route added • MP: route not added
correct	local	route added (always)
correct	not local	• PTP: route added[1] • MP: rerouted
incorrect	-	route not added
no name	local for an interface	routed added
no name	not local for an interface Exception: • GW = none (0.0.0.0) • GW lies in configured network route	rerouted to gateway • route not added • route not added

1. In the routingTable status, the configured gateway will appear but for the routing itself the gateway is ignored.

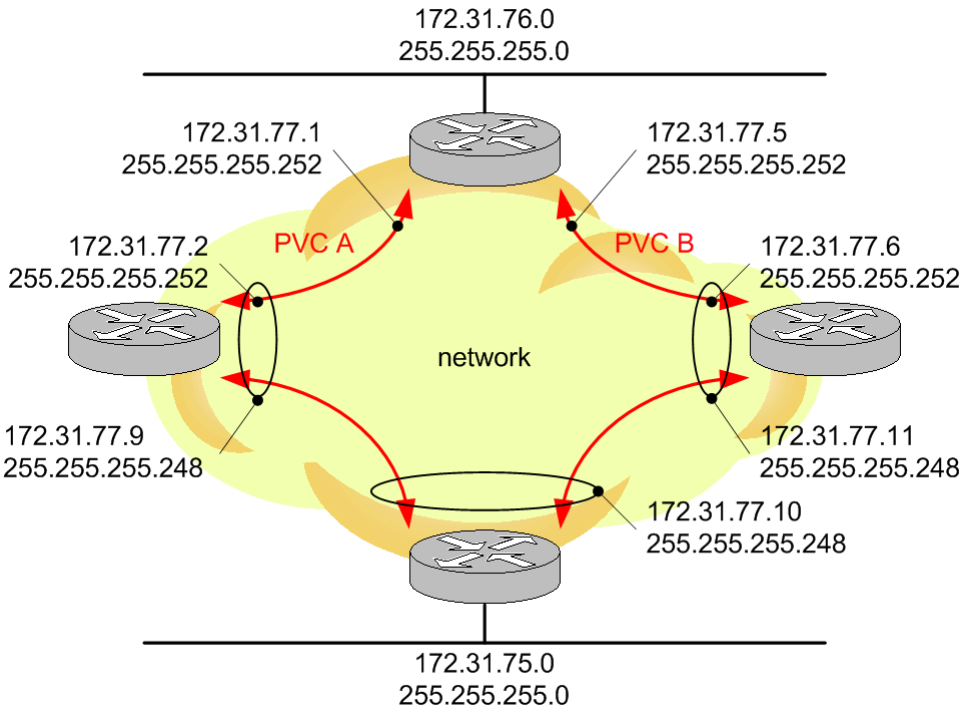
10.3.5 The rerouting principle

What is the rerouting principle?

If the gateway of a route does not belong to the subnet of an interface, then the Telindus 1431 SHDSL CPE adds a special route. Then a second route look-up occurs, this time using the gateway field of the route. This can be used as a back-up functionality as shown below.

Example

Suppose you have the following set-up:



In the routing table, the following routes are defined:

- network 172.31.75.0 is reachable via 172.31.77.10
- 172.31.77.10 is reachable via PVC A (172.31.77.2)
- 172.31.77.10 is also reachable via PVC B (172.31.77.6)

routingTable

	network	mask	gateway	interface	preference	metric
1	172.31.75.0	255.255.255.0	172.31.77.10		10	2
2	172.31.77.10	255.255.255.248	172.31.77.2	wan	10	2
3	172.31.77.10	255.255.255.248	172.31.77.6	wan	10	2

Now in order to reach network 172.31.75.0, PVC A is used. However, when PVC A goes down, the Telindus 1431 SHDSL CPE automatically uses PVC B in order to reach network 172.31.75.0. I.e. it automatically “reroutes” and this without the need of a routing protocol.

Important remarks

- This only works for the entries of the routing table, *not* for the default gateway.
- This type of route is always up.
- In the status information, the interface element of such a route displays internal.

10.4 Configuring policy based routing

This section introduces the policy based routing and gives a short description of the attributes you can use to configure policy based routing.

The following gives an overview of this section:

- 10.4.1 - Introducing policy based routing on page 199
- 10.4.2 - Setting up policy based routing on page 200

10.4.1 Introducing policy based routing

What is policy based routing?

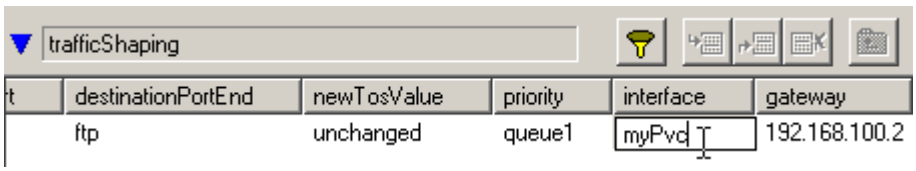
Normal routing is based on the destination IP address. Policy based routing offers the possibility to define different routing entries based on additional information. Traffic is routed to a certain interface or gateway based on e.g. the source IP address, the IP protocol, etc.

10.4.2 Setting up policy based routing

Refer to 10.4.1 - Introducing policy based routing on page 199 for an introduction.

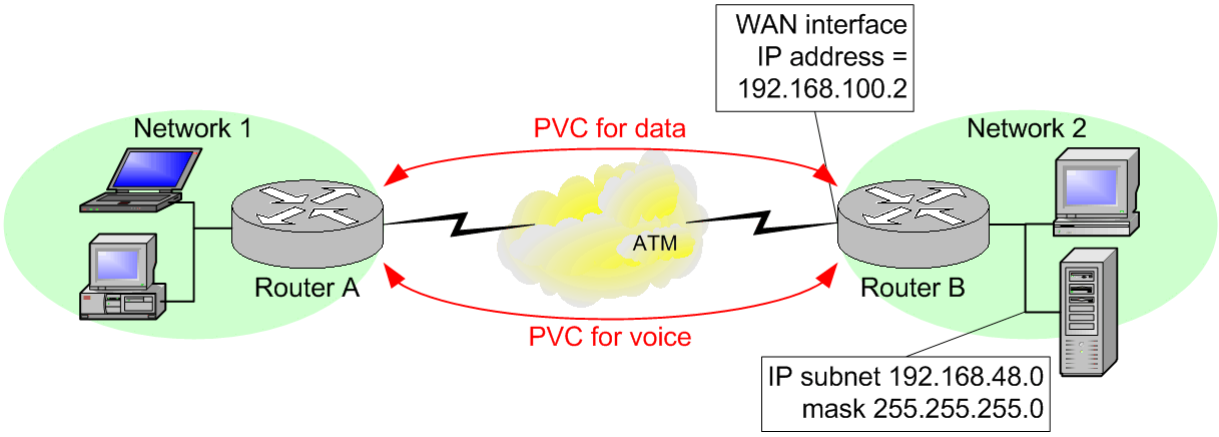
To configure policy based routing, proceed as follows:

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>In the Telindus 1431 SHDSL CPE containment tree, go to the router object and add a trafficPolicy[ ] object underneath (refer to 4.4 - Adding an object to the containment tree on page 49).
</td></tr>
<tr><td>2</td><td>Select a traffic policy method. Do this using the method attribute in the traffic policy object you added in step 1.

In case of policy based routing, you can only use trafficShaping or tosMapped, not tosDiffServ.</td></tr>
<tr><td>3</td><td>Configure the policy criteria for the traffic policy method you selected in step 2.
<table>
<tr><th>If you choose the method …</th><th>then use the following attribute in the traffic policy object to configure the policy criteria:</th></tr>
<tr><td>trafficShaping,</td><td>trafficShaping.
So using the elements in this table you can route traffic based on IP source and destination address, TOS values, IP protocol, etc.</td></tr>
<tr><td>tosMapped,</td><td>tos2QueueMapping.
So using the elements in this table you can route traffic based on TOS values.</td></tr>
</table>
For more information on these attributes, refer to …
• telindus1431Router/router/trafficPolicy[ ]/trafficShaping on page 521.
• telindus1431Router/router/trafficPolicy[ ]/tos2QueueMapping on page 526.</td></tr>
<tr><td>4</td><td>Now you have to determine to which interface and gateway the traffic is routed. Do this using the interface and gateway elements that you find in the traffic policy tables you configured in step 3.
 
</td></tr>
</table>

Example - configuring policy based routing

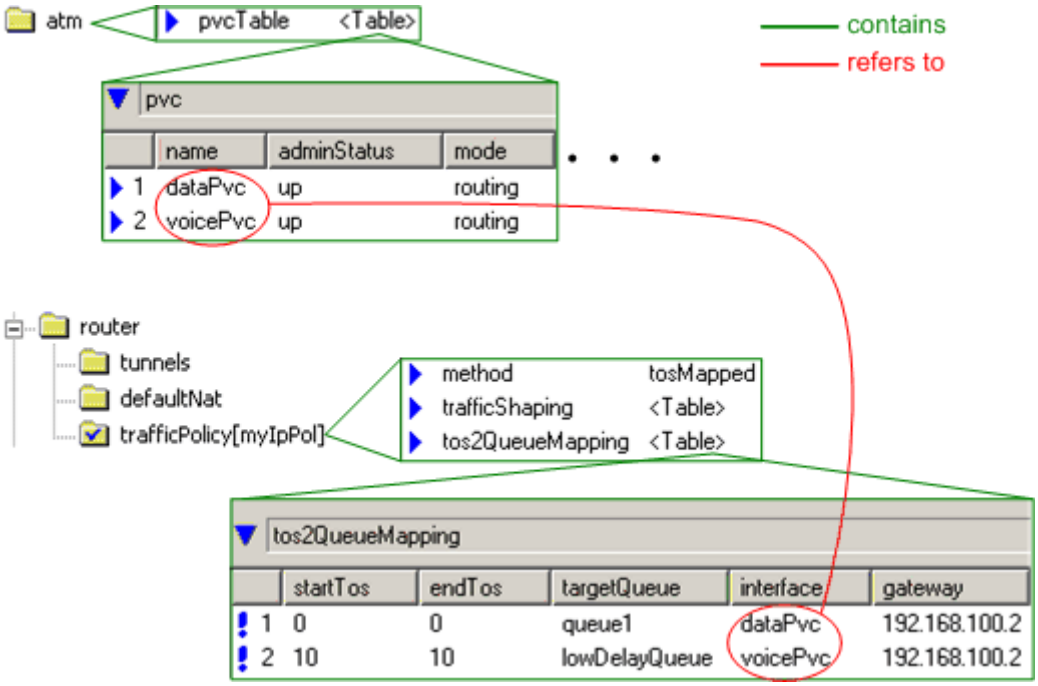
Suppose you have two networks which are interconnected over an ATM network. Network 1 carries a mix of data and voice traffic. The traffic on this network is differentiated by setting the Type Of Service (TOS) values in the IP packet headers (data = 0, voice = 10). When the traffic is routed from network 1 to network 2 you want that the data traffic and the voice traffic each go over a separate PVC.



Sketched in broad outlines, this is how you configure the above:

Step	Action
1	Set up two ATM PVCs. For example: • Configure one ATM PVC that will carry the data traffic, e.g. pvcTable/name = dataPvc. • Configure another ATM PVC that will carry the voice traffic, e.g. pvcTable/name = voicePvc. Since this is not the main subject of this example, refer for more information on creating ATM PVCs to 9.1.3 - Configuring ATM PVCs (IP LAN PVC) on page 140.
2	Create and configure an IP traffic policy for policy based routing purposes. For example: • Create a trafficPolicy[myIpPol] object. • Set the method attribute to tosMapped. • In the tos2QueueMapping table, create two entries and define the startTos, endTos, interface and gateway elements of each entry in such a way that the data traffic and the voice traffic each go over a separate PVC.

The following figure shows how to configure policy based routing:



10.5 Configuring RIP

This section introduces the Routing Information Protocol (RIP) and gives a short description of the attributes you can use to configure RIP.

The following gives an overview of this section:

- 10.5.1 - Introducing RIP on page 204
- 10.5.2 - Enabling RIP on an interface on page 205
- 10.5.3 - Explaining the rip structure on page 207
- 10.5.4 - Enabling RIP authentication on an interface on page 210

10.5.1 Introducing RIP

What is RIP?

The Routing Information Protocol (RIP) is a protocol that routers use to exchange dynamic routing information. RIP can be enabled or disabled per interface.

There are two main RIP modes:

RIP mode	Description
passive	Received RIP updates are parsed, but no RIP updates are transmitted.
active	RIP updates are transmitted and received.

How does RIP work?

When RIP is enabled, the Telindus 1431 SHDSL CPE advertises every 30 seconds its routing information to adjacent routers. It also receives the routing information from the adjacent routers. With this information it adapts its routing table dynamically. If after 180 seconds no information about a certain route has been received, then this route is declared *down*. If after an additional 120 seconds (i.e. 300 seconds in total) still no information about the route has been received, then this route is deleted from the routing table.

RIP support

The Telindus 1431 SHDSL CPE supports RIP protocol version 1, 1-compatible and 2. RIP version 1 is a very common routing protocol. Version 2 includes extra features like variable subnet masks and authentication. Check which RIP version is used by the other routers in the network.

Currently, the RIPv2 routing protocol requires the use of an IP address on the WAN interface.

RIP authentication

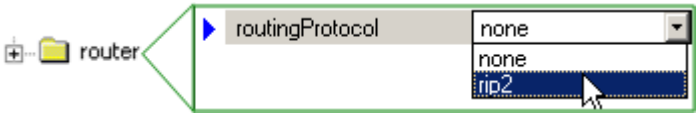
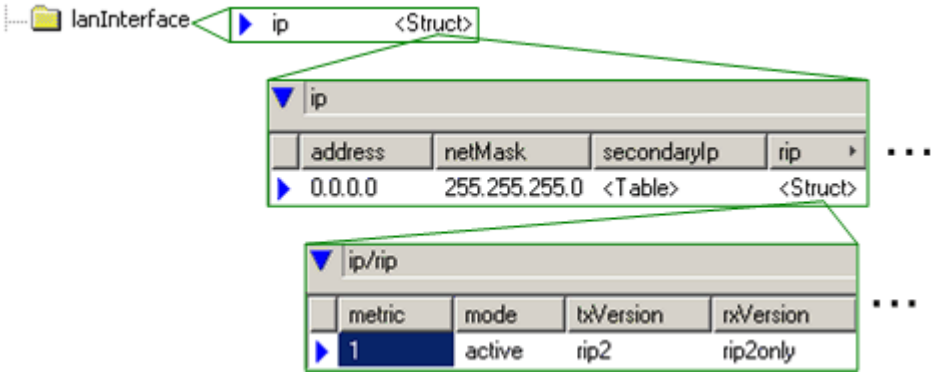
For security reasons the RIP updates that are exchanged between routers can be authenticated. RIP authentication can be enabled or disabled per interface.

10.5.2 Enabling RIP on an interface

Refer to …

- 10.3.1 - Introducing static routing on page 191 for a comparison between static and dynamic (e.g. using RIP) routing.
- 10.5.1 - Introducing RIP on page 204 for an introduction on RIP.

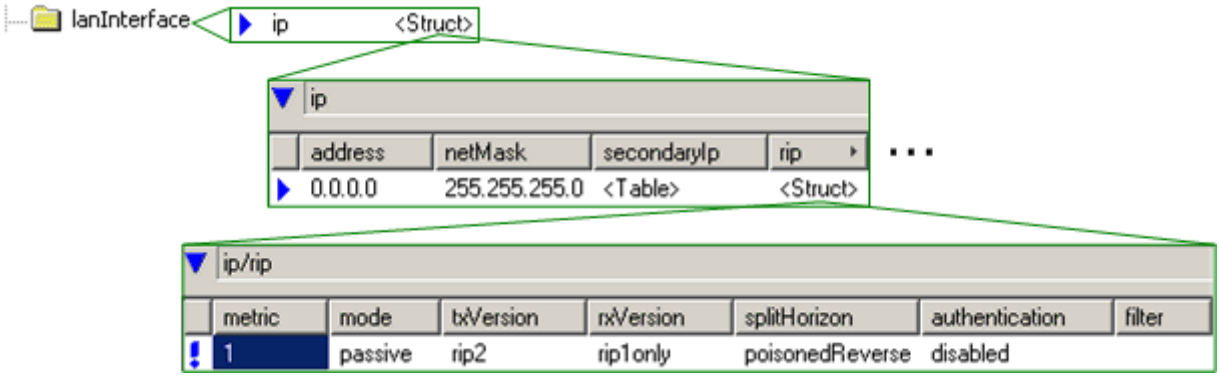
To enable dynamic routing using RIP on an IP interface, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and set the routingProtocol attribute to rip.  This activates the general RIP process on the Telindus 1431 SHDSL CPE. Now you can activate or deactivate RIP per IP interface. Note that by default RIP is activated on all IP interfaces.
2	Each IP interfaces has an ip structure. Within this ip structure you find a rip structure. Use the following elements in the rip structure to activate or deactivate RIP per IP interface: • mode. Use this element to set the transmission and/or reception of RIP updates on the interface. By default the Telindus 1431 SHDSL CPE transmits and receives RIP updates on all interfaces. • txVersion. Use this element to set the version of the RIP updates that are transmitted on the interface. • rxVersion. Use this element to set which version of received RIP updates is accepted on the interface. For example, the following shows the location of the rip structure on the LAN interface:  Refer to … • 5.2.2 - Where to find the IP parameters? on page 59 for the location of the ip structure on the different IP interfaces. The rip structure is located within the ip structure. • 10.5.3 - Explaining the rip structure on page 207 for a detailed explanation of the rip structure.

Example - configuring RIP

Suppose you want to activate RIP on the LAN interface. What is more, you want that the LAN interface does not transmit RIP updates but only parses received RIP updates (passive RIP). Furthermore, you only want to accept RIP version 1 updates on the LAN interface.

The following figure shows how to configure this:



Note that since in this example the mode element is set to passive, the txVersion element is ignored.

10.5.3 Explaining the rip structure

Because the rip structure occurs in several objects, it is described here once and referenced where necessary. The rip structure is located within the ip structure. Refer to 5.2.2 - Where to find the IP parameters? on page 59 for the location of the ip structure.

The rip structure contains the following elements:

Element	Description
metric	Use this element to determine with how much the Telindus 1431 SHDSL CPE increments the metric parameter of a route. Default:1 Range: 1 ... 15 Routing information includes a metric parameter. Every time a router is passed, this parameter is incremented. Also the Telindus 1431 SHDSL CPE increments the metric parameter (default by 1) before it writes the route in the routing table. Hence, the metric parameter indicates for each route how many routers have to be passed before reaching the network. When several routes to a single network exist and they all have the same preference, then the route with the smallest metric parameter is chosen. However, using the metric element, you can increment the metric parameter by more than 1 (up to a maximum of 15). You could do this, for instance, to indicate that a certain interface is less desirable to route through. As a result, the Telindus 1431 SHDSL CPE adds this value to the metric parameter of every route learnt through that interface. The metric parameter is also used to represent the directly connected subnets on the LAN and WAN interfaces.
mode	Use this element to set the transmission and/or reception of RIP updates on the interface. By default the Telindus 1431 SHDSL CPE transmits and receives RIP updates on all interfaces. Default:active Range: enumerated, see below The mode element has the following values: • active. RIP updates are transmitted and received on this interface. • passive. RIP updates are not transmitted on this interface, but received updates are parsed. • disabled. RIP updates are nor transmitted nor received on this interface.
txVersion	Use this element to set the version of the RIP updates that are transmitted on the interface. Default:rip2 Range: enumerated, see below The txVersion element has the following values: • rip1. The transmitted RIP updates are RIP version 1 updates. • rip2. The transmitted RIP updates are RIP version 2 updates. • rip1-compatible. The contents of the RIP update packet is a RIP version 2 packet, but it is encapsulated as a RIP version 1 packet. This allows some older implementations of RIP 1 to be interoperable with RIP 2.

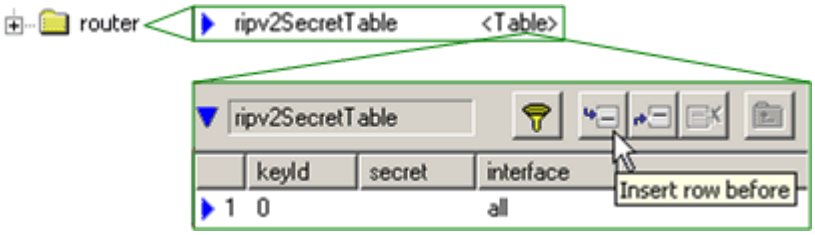
Element	Description
rxVersion	Use this element to set which version of received RIP updates is accepted on the interface. Default:rip2only Range: enumerated, see below The rxVersion element has the following values: • rip1only. Only RIP version 1 received RIP updates are accepted. • rip2only. Only RIP version 2 received RIP updates are accepted. • rip1&2. Both RIP version 1 and 2 received RIP updates are accepted. If you want to accept RIP1-compatible updates on the interface, then set the rxVersion attribute to rip1&2.
splitHorizon	Use this element to enable or disable split horizon operation. Default:poisonedReverse Range: enumerated, see below The splitHorizon element has the following values: • disabled. Split horizon is disabled. • enabled. Split horizon is enabled. Split horizon operation prevents that routing information exits the interface through which the information was received in the first place. This optimises communications among multiple routers, particularly when links are broken. It also prevents routing loops. • poisonedReverse. Poisoned reverse split horizon is used. Whereas “simple” split horizon simply omits the routes learned from one neighbour in updates sent to that neighbour, poisoned reverse split horizon includes such routes in updates but sets their metrics to infinity.

Element	Description
authentication	Use this element to enable or disable RIP authentication. Default:disabled Range: enumerated, see below Refer to 10.5.4 - Enabling RIP authentication on an interface on page 210 for more information on RIP authentication. The authentication element has the following values: • disabled. No authentication is used. • text. The authentication secret is exchanged in clear text. • md5. Instead of sending the authentication secret together with the RIP updates, it is hashed together with the routing information into a unique value. This authentication is the most secure. This because it provides also protection against tampering with the contents of a packet: both an incorrect password and modified routing information result in different hash values. **Remarks** •If authentication is enabled (either text or md5), then only updates using that authentication are processed. All other updates on that interface are discarded. • If you use md5 and if for a certain interface multiple secrets are present in the ripv2SecretTable, then the first entry in the ripv2SecretTable is used to transmit RIP updates. Authentication of the received RIP updates is done by looking for the first secret with a matching key. • If you use text and if for a certain interface multiple secrets are present in the ripv2SecretTable, then only the first entry in the ripv2SecretTable is used to transmit and receive RIP updates.
filter	Use this element to apply a filter on the RIP updates on the interface. Default:<empty> Range: 0 ... 24 characters Do this by entering the index name of the filter you want to use. You can create the filter itself by adding a routingFilter object and by configuring the attributes in this object. **Example** If you created a routingFilter object with index name my_filter (i.e. routingFilter[my_filter]) and you want to apply this filter here, then enter the index name as value for the filter element. Refer to … • 14.9.6 - Routing filter configuration attributes on page 517 for more information on RIP filtering. • 4.4 - Adding an object to the containment tree on page 49 for more information on adding objects.

10.5.4 Enabling RIP authentication on an interface

Refer to 10.5.1 - Introducing RIP on page 204 for an introduction on RIP authentication.

To enable RIP authentication on a certain interface, proceed as follows:

Step	Action
1	In the rip structure, set the authentication element to … • text. RIP authentication is enabled and the authentication secret is sent along with the RIP updates in clear text. • md5. RIP authentication is enabled and the authentication secret is hashed together with the routing information into a unique value. Refer to 10.5.3 - Explaining the rip structure on page 207.
2	In the Telindus 1431 SHDSL CPE containment tree, go to the router object, select the ripv2SecretTable attribute and add one or more entries to this table. 
3	Configure the elements of an entry in the ripv2SecretTable attribute: • keyId. Use this element to set a unique identifier for each secret. • secret. Use this element to define the secret. This secret is sent with the RIP updates on the specified interface. It is also used to authenticate incoming RIP updates. • interface. Use this element to specify on which interface the secret is used. Do this by typing the name of the interface as you assigned it using the configuration attribute name (e.g. telindus1431Router/lanInterface/name). Note that the “interface” can also be a DLCI, PVC, tunnel, etc. Entering the string “all” (default) means the secret is used on all the interfaces. Refer to telindus1431Router/router/ripv2SecretTable on page 474 for more information.

10.6 Configuring OSPF

This section introduces the OSPF protocol. The following gives an overview of this section:

- 10.6.1 - Introducing OSPF on page 212
- 10.6.2 - Activating OSPF on page 217
- 10.6.3 - Enabling OSPF authentication on page 218

10.6.1 Introducing OSPF

What is OSPF?

The Open Shortest Path First (OSPF) protocol is an Interior Gateway Protocol used to distribute routing information within a single Autonomous System.

On the Internet, an autonomous system (AS) is either a single network or a group of networks that is controlled by a common network administrator (or group of administrators) on behalf of a single administrative entity (such as a university, a business enterprise, or a business division). An autonomous system is also sometimes referred to as a routing domain.

Using OSPF, a host that obtains a change to a routing table or detects a change in the network immediately multicasts the information to all other hosts in the network so that all will have the same routing table information. Unlike the RIP in which the entire routing table is sent, the host using OSPF sends only the part that has changed. With RIP, the routing table is sent to a neighbour host every 30 seconds. OSPF multicasts the updated information only when a change has taken place.

What are the OSPF link states?

Rather than simply counting the number of hops, OSPF bases its path descriptions on "link states" that take into account additional network information. That is why OSPF is called a link-state protocol. A link can be seen as an interface on the router. The state of the link is a description of that interface and of its relationship to its neighbouring routers. A description of the interface would include, for example, the IP address of the interface, the mask, the type of network it is connected to, the routers connected to that network and so on.

Each router in the Autonomous System originates one or more link state advertisements (LSAs). The collection of LSAs forms the link-state database. Each separate type of LSA has a separate function. There 4 distinct types of LSAs*:*

Link State Packets	Description
Router-LSAs	• Describes the state and cost of the router ‘s links (interfaces) to the area, i.e. intra-area. • Each router will generate a Router-LSA for all of its interfaces.
Network-LSAs	Network-LSAs are generated by a Designated Router (DR) on a segment. This information is an indication of all routers connected to a particular multi-access segment such as Ethernet, Token Ring and FDDI (DRs will be discussed further down).
Summary-LSAs	• Summary-LSA ‘s provide a way of condensing an area's routing information. • Summary-LSA ‘s describe networks in the Autonomous System, but outside of an area, i.e. inter-area. Summary links are generated by an Area Border Router (ABR, ABRs will be discussed further down). • By generating summary links, the network reachability information is shared between areas. Normally, all information is injected into the backbone (area 0) and in turn the backbone will pass it on to other areas. ABRs also have the task of propagating the reachability of the ASBR. This is how routers know how to get to external routes in other Autonomous Systems.

Link State Packets	Description
AS-external-LSAs	• AS-external-LSAs provide a way of transparently advertising externally-derived routing information throughout the Autonomous System • AS-external-LSAs are an indication of networks outside of the AS. These networks are injected into OSPF via redistribution. External links are generated by an ASBR (ASBRs will be discussed further down). The ASBR has the task of injecting these routes into an autonomous system.

What is the backbone area or area 0?

OSPF has special restrictions when multiple areas are involved. If more than one area is configured, one of these areas has be to be area 0. This is called the backbone. When designing networks it is good practice to start with area 0 and then expand into other areas later on.

The backbone has to be at the centre of all other areas, i.e. all areas have to be physically connected to the backbone. The reasoning behind this is that OSPF expects all areas to inject routing information into the backbone and in turn the backbone will disseminate that information into other areas.

What are areas and border routers?

OSPF uses flooding to exchange link-state updates between routers. Any change in routing information is flooded to all routers in the network. Areas are introduced to put a boundary on the explosion of link-state updates. All routers within an area have the exact link-state database.

A router that has all of its interfaces within the same area is called an *internal router (IR)*.

Routers that belong to multiple areas, and connect these areas to the backbone area are called *area border routers (ABR)*. ABRs must therefore maintain information describing the backbone areas and other attached areas.

Routers that act as gateways (redistribution) between OSPF and other routing protocols (e.g. RIP) are called *autonomous system boundary routers (ASBR)*.

In order to minimize the amount of information exchange on a particular segment, OSPF elects one router to be a *designated router (DR)*, and one router to be a *backup designated router (BDR)*, on each multi-access segment. The BDR is elected as a backup mechanism in case the DR goes down (the DR and BDR are elected based upon their OSPF priority). The idea behind this is that routers have a central point of contact for information exchange. Instead of each router exchanging updates with every other router on the segment, every router exchanges information with the DR and BDR. The DR and BDR relay the information to everybody else.

What are stub areas?

OSPF allows certain areas to be configured as stub areas. External networks, such as those redistributed from other protocols into OSPF, are not allowed to be flooded into a stub area. Routing from these areas to the outside world is based on a default route. Configuring a stub area reduces the topological database size inside an area and reduces the memory requirements of routers inside that area.

An area can be called a stub when there is a single exit point from that area or if routing to outside of the area does not go via an optimal path. The latter description is just an indication that a stub area that has multiple exit points, will have one or more area border routers injecting a default into that area.

All OSPF routers inside a stub area have to be configured as stub routers. This is because whenever an area is configured as stub, all interfaces that belong to that area will start exchanging Hello packets with a flag that indicates that the interface is stub. All routers that have a common segment have to agree on that flag. If they don't, then they will not become neighbours and routing will not take effect.

What are NSSAs?

Not-so-stubby areas are a type of stub area in which external routes can be flooded.

OSPF areas flood all external routes across area borders. In the presence of large number of external routes, this may be a problem, as external routes cannot be summarized at the ABRs. Stub areas are designed to alleviate the problem by preventing external routes from being injected into the stub area, and instead a default route is injected. Stub areas are incapable of carrying external routes (Type 5 LSAs), and hence are incapable of supporting ASBRs.

NSSAs allow for supporting ASBRs within the NSSA, while maintaining the same behaviour as stub areas of not injecting external (Type 5) routes coming from the backbone. Thus NSSA routers benefit from the significant reduction of external routes coming from the backbone, while having the capability to carry a limited number of externals that originate in the NSSA.

To provide the ability of carrying external routes originated in the NSSA, a new LSA type was defined, Type 7 LSA. It has the structure and semantics of a Type 5 (External) LSA, with a two differences:

- Type 7 LSAs can be originated and propagated within the NSSA, they do not cross area borders like Type 5 LSAs do.
- Type 5 LSAs are not supported in NSSA; they can be neither originated nor propagated in NSSA.

In order to allow limited exchange of external information across an NSSA border, NSSA border routers will translate selected Type-7 LSAs received from the NSSA into Type-5 LSAs. These Type-5 LSAs will be flooded to all Type-5 capable areas. NSSA border routers may be configured with address ranges so that multiple Type-7 LSAs may be aggregated into a single Type-5 LSA. The NSSA border routers that perform translation are configurable. In the absence of a configured translator one is elected.

What are neighbours and adjacency?

Routers that share a common segment become *neighbours* on that segment. Neighbours are discovered via the Hello protocol. Hello packets are sent periodically out of each interface using IP multicast. Routers become neighbours as soon as they see themselves listed in the neighbour's Hello packet. This way, a two way communication is guaranteed.

Adjacency is the next step after the neighbouring process. Adjacent routers are routers that go beyond the simple Hello exchange and proceed into the database exchange process. In order to minimize the amount of information exchange on a particular segment, OSPF elects one router to be a designated router (DR), and one router to be a backup designated router (BDR), on each multi-access segment (refer to What are areas and border routers? on page 213).

What is OSPF cost?

The cost of an interface in OSPF is an indication of the overhead required to send packets across a certain interface. The cost of an interface is inversely proportional to the bandwidth of that interface. A higher bandwidth indicates a lower cost. There is more overhead (higher cost) and time delays involved in crossing a 56k serial line than crossing a 10M ethernet line.

The cost of an interface can either be calculated automatically, or the user can overrule the calculated cost by using his own configuration so that some paths are given preference.

The formula used to calculate the cost is:

cost = reference bandwidth (in bps) / interface bandwidth (in bps)

The *reference bandwidth* can be set by the user.

Virtual links

Virtual links are used for two purposes:

- Linking an area that does not have a physical connection to the backbone.
- Patching the backbone in case discontinuity of area 0 occurs.

As mentioned earlier, area 0 has to be at the centre of all other areas. In some rare case where it is impossible to have an area physically connected to the backbone, a virtual link is used. The virtual link will provide the disconnected area a logical path to the backbone. The virtual link has to be established between two ABRs that have a common area, with one ABR connected to the backbone.

OSPF authentication

It is possible to authenticate the OSPF packets so that routers can participate in routing domains based on predefined passwords. By default, a router uses a Null authentication which means that routing exchanges over a network are not authenticated. Two other authentication methods exist: Simple Password authentication and Message Digest authentication (MD-5):

Authentication	Description
Null authentication	No authentication is used.
Simple Password authentication	This allows a password (key) to be configured per interface. Interfaces of different routers that want to exchange OSPF information will have to be configured with the same key.
Message Digest authentication (MD-5)	This is a cryptographic authentication. A key (password) and key-id are configured on each router. The router uses an algorithm based on the OSPF packet, the key, and the key-id to generate a "message digest" that gets appended to the packet. Unlike the simple authentication, the key is not exchanged over the wire.

OSPF authentication can be enabled or disabled per interface.

10.6.2 Activating OSPF

Refer to 10.6.1 - Introducing OSPF on page 212 for an introduction on OSPF.

OSPF does not need to be activated as such. By modifying the configuration attributes under the router/ospf and router/ospf/Area[ ] objects, OSPF can be applied within an autonomous system. Refer to 14.9.5 - OSPF configuration attributes on page 503.

The router/ospf/Area[ ] object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

10.6.3 Enabling OSPF authentication

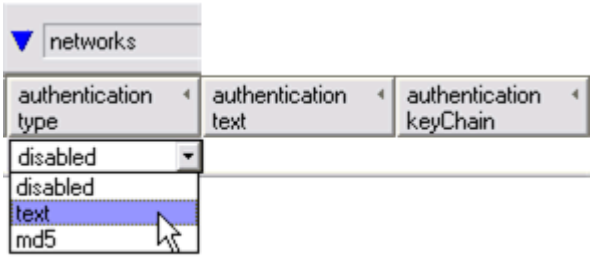
Refer to 10.6.1 - Introducing OSPF on page 212 for an introduction on OSPF authentication.

There are two authentication methods:

- simple password authentication. Refer to Enabling simple password authentication on page 218.
- MD-5 authentication. Refer to Enabling MD-5 authentication on page 219.

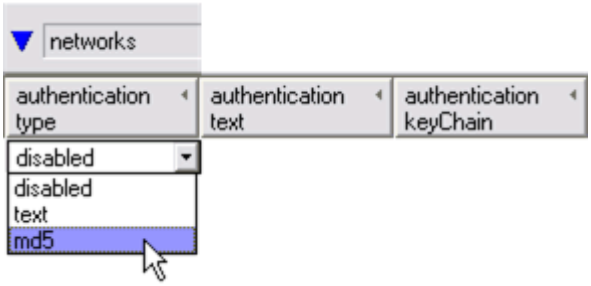
Enabling simple password authentication

To enable simple password authentication, proceed as follows:

Step	Action
1	In the containment tree, go to the router/ospf/Area[ ] object, and select the networks configuration attribute. In the authentication structure, set the authentication type element to text. 
2	In the authentication text element, type the password.

Enabling MD-5 authentication

To enable MD-5 authentication, proceed as follows:

Step	Action
1	In the containment tree, go to the router/ospf object and select the keyChains configuration attribute. In the keyChains table, add a new chain.
2	In the chain table, set the elements correctly. Refer to telindus1431Router/router/ospf/keyChains/chain on page 506.
3	In the containment tree, go to the router/ospf/Area[ ] object, and select the networks configuration attribute. In the authentication structure, set the authentication type element to md5. 
4	In the authentication keyChain element, type the name of the key chain that will be used.

In the screenshots above, the authentication structure is explained as being part of the networks table. Note that the authentication structure is also present in the virtualLinks table.

10.7 Configuring address translation

This section explains Network Address Translation (NAT) and Port Address Translation (PAT). Firstly, it gives an introduction. Secondly, a table is presented that will help you to determine which translation method meets your requirements. Then this section teaches you how to configure NAT and PAT.

The following gives an overview of this section:

- 10.7.1 - Introducing address translation on page 221
- 10.7.2 - When use NAT and/or PAT on page 222
- 10.7.3 - Enabling PAT on an interface on page 223
- 10.7.4 - How does PAT work? on page 225
- 10.7.5 - PAT limitations and work-arounds on page 228
- 10.7.6 - Enabling NAT on an interface on page 229
- 10.7.7 - Adding multiple NAT objects on page 231
- 10.7.8 - How does NAT work? on page 233
- 10.7.9 - Combining PAT and NAT on page 235
- 10.7.10 - Easy NAT on PPP on page 235

10.7.1 Introducing address translation

What is address translation?

Address translation is used to translate private IP addresses into official IP addresses. This is also known as IP masquerading.

Why use address translation?

Each device connected to the Internet must have an *official* (i.e. unique) IP address. The success of the Internet has caused a lack of these official IP addresses. As a result, your Internet Service Provider (ISP) may offer you only one or a small number of official IP addresses.

If the number of IP devices on your local network is larger than the number of official IP addresses, you can assign test or *private* IP addresses to your local network. In that case, you have to configure your access router to translate IP addresses using NAT or PAT.

Even when there are sufficient official IP addresses available, you may still choose to use NAT e.g. for preserving previously assigned test addresses to all the devices on your local network.

What is NAT?

Network Address Translation (NAT) is an Internet standard that enables a local area network (LAN) to use one set of IP addresses for internal traffic (private IP addresses) and a second set of addresses for external traffic (official IP addresses). The access router (located where the LAN meets the Internet) makes all necessary IP address translations. This is a dynamic process.

NAT serves three main purposes:

- Provides a type of firewall by hiding internal IP addresses.
- Enables a company to use more internal IP addresses. Since these are used internally only, there is no possibility of conflict with IP addresses used by other companies and organizations.
- Allows a company to combine multiple ISDN connections into a single Internet connection.

The number of simultaneous users with Internet access is limited to the number of official IP addresses.

What is PAT?

Port Address Translation (PAT) is a type of Network Address Translation. During PAT, each computer on LAN is translated to the same IP address, but with a different port number assignment.

Only outgoing TCP sessions are supported.

Private IP address range

The international authority IANA assigns the official (also called global) IP addresses. It has also defined 3 ranges of IP addresses for private use. This means that you can use these addresses without registration on your internal network, as long as you are not connected to the Internet.

Private IP address range	Remarks
10.0.0.0 - 10.255.255.255	1 class A network
172.16.0.0 - 172.31.255.255	16 class B networks
192.168.0.0 - 192.168.255.255	256 class C networks

You can define (sub-)networks in these ranges for your *private IP addresses*.

10.7.2 When use NAT and/or PAT

Refer to 10.7.1 - Introducing address translation on page 221 for an introduction on NAT and PAT authentication.

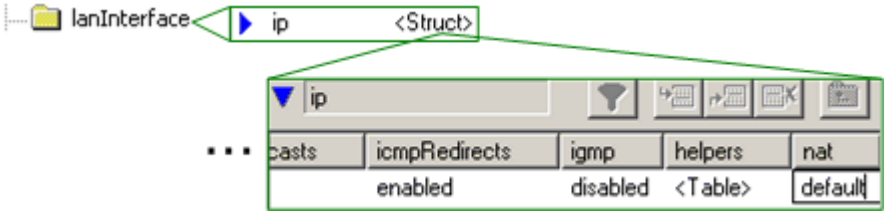
Check in the next table whether you need NAT and/or PAT:

No. of official IP addresses	No. of devices on local network	Use NAT of PAT?	Refer to …
1	more than 1	Use PAT.	10.7.3 - Enabling PAT on an interface on page 223
k (> 1)	more than k	Use NAT in combination with PAT.	10.7.9 - Combining PAT and NAT on page 235
at least k	k (≥ 1)	1. No translation needed. 2. If you want translation, use NAT.	1. Skip this section. 2. 10.7.6 - Enabling NAT on an interface on page 229

10.7.3 Enabling PAT on an interface

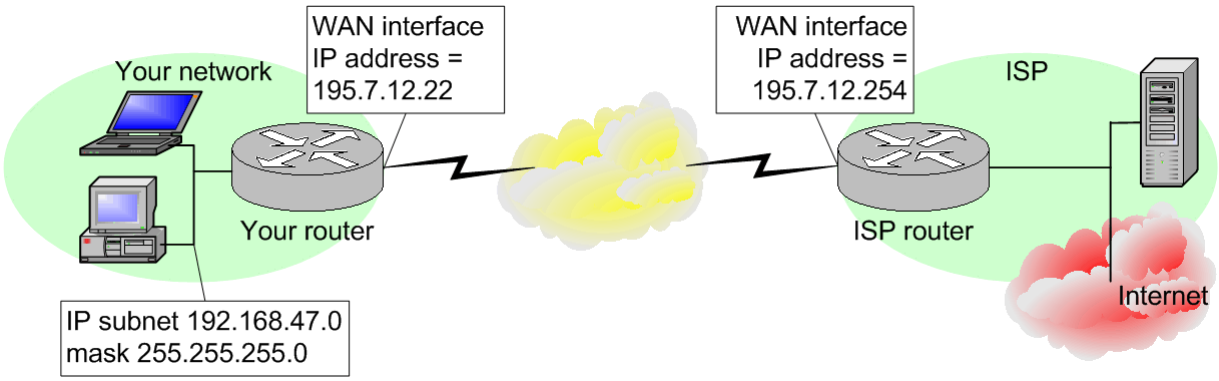
Refer to 10.7.1 - Introducing address translation on page 221 for an introduction on PAT.

To enable PAT on a certain interface, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router/defaultNat object. In this object, configure the patAddress attribute. Use this attribute to enter the official IP address that has to be used for the Port Address Translation. Entering an address different from the default value 0.0.0.0 automatically enables the general PAT process. Now you can activate or deactivate PAT per IP interface. Note that by default PAT is deactivated on all IP interfaces.
2	In the router/defaultNat object, configure the gateway attribute. Use this attribute to define the gateway address of routes on which PAT should be applied. If you do not configure the gateway attribute, then PAT is applied on all routes through this interface.
3	Each IP interfaces has an ip structure. Use the following element in the ip structure to activate or deactivate PAT per IP interface: • nat. Use this element to enable address translation on the interface with the official IP addresses. Do this by entering the string “default“ as nat element value. By doing so, the settings are applied as defined in the router/defaultNat object. For example, the following shows the location of the ip structure on the LAN interface:  Refer to 5.2.2 - Where to find the IP parameters? on page 59 for the location of the ip structure on the different IP interfaces.

Example - configuring PAT

Suppose your network is connected over a network of an operator to an Internet Service Provider (ISP). You received only one single official IP address from you ISP, being 195.7.12.22.



The following shows how to enable PAT:

- In the router/defaultNat object, set the patAddress attribute to 195.7.12.22. In that case, the PAT address is the same as the IP address that is used on the WAN interface.
- In the router/defaultNat object, set the gateway attribute to 195.7.12.254. If, however, you already defined the router/defaultRoute attribute to be 195.7.12.254, then you can leave the gateway attribute empty. This because if the gateway attribute is empty, then the defaultRoute attribute is taken as only gateway addresses.
- In the ip structure of the WAN interface, type the string “default” as value of the nat element.

10.7.4 How does PAT work?

Again consider the network topology as depicted in 10.7.3 - Enabling PAT on an interface on page 223.

The following two paragraphs explain how the Telindus 1431 SHDSL CPE treats the outgoing and incoming traffic when PAT is applied:

- Outgoing traffic (to the Internet) on page 225.
- Incoming traffic (from the Internet) on page 227.

Outgoing traffic (to the Internet)

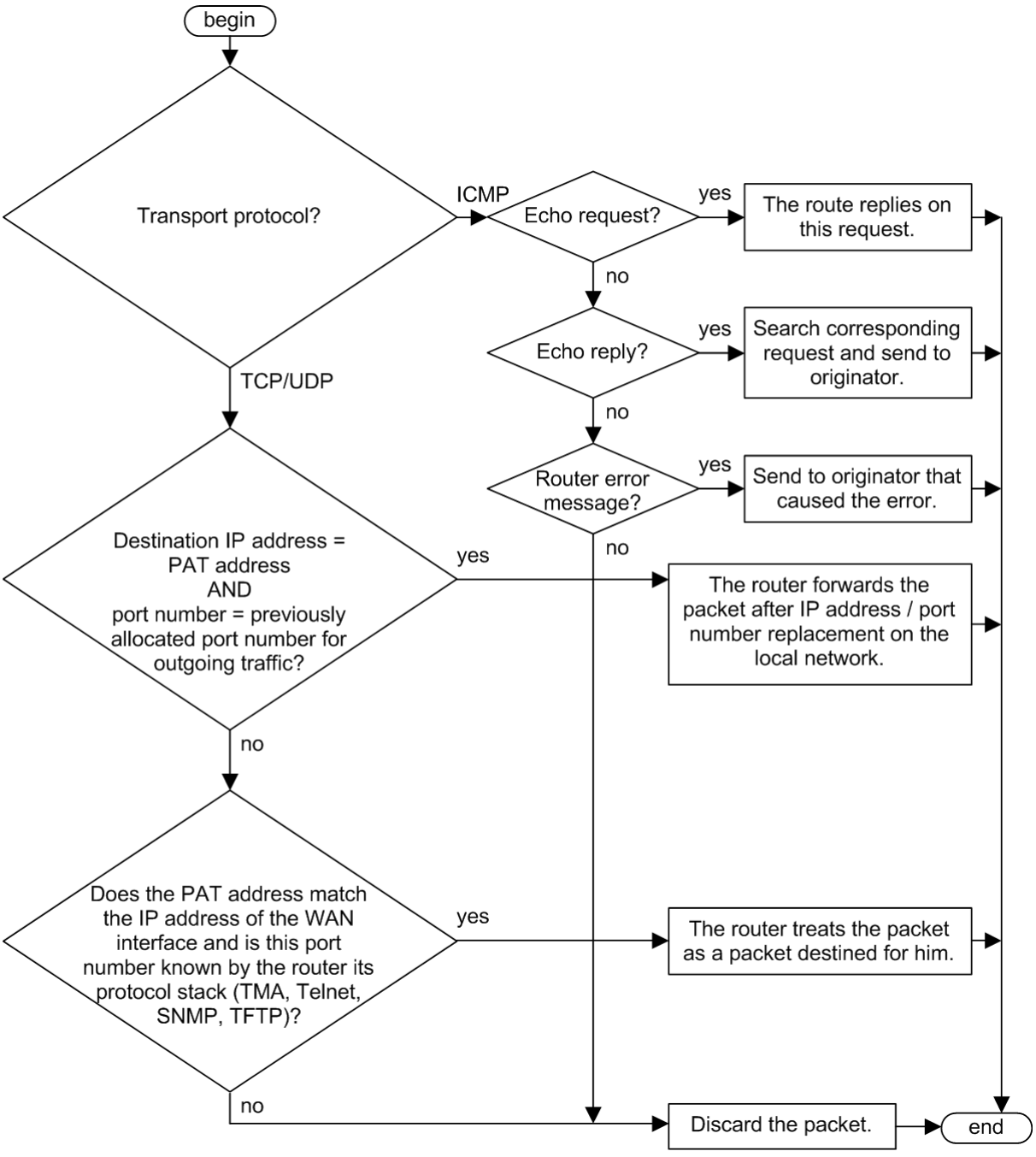
The Telindus 1431 SHDSL CPE replaces the source address by its PAT address in all the traffic coming from the local network and destined for the Internet. Depending on the IP transport protocol and the number of simultaneous users accessing the Internet, the Telindus 1431 SHDSL CPE takes different actions:

Protocol		
TCP	**Description**	This is a connection-oriented protocol: two devices communicating with the TCP protocol build a session before exchanging user data. When they have finished exchanging user data, the session is closed. Examples of such applications are Telnet, HTTP and FTP. The TCP header contains a *port* field indicating the higher-layer protocol.
	Action	When a session is started, a specific port number is assigned to this session. All traffic from this session is assigned this specific port number. The specific port number is freed within 5 minutes after the TCP session is closed (i.e. after TCP Reset or TCP Finish is seen). If the session has not been properly closed, the port number is freed 24 hours after the last session traffic. This time is configurable (refer to telindus1431Router/router/defaultNat/tcpSocketTimeOut on page 490).
UDP	**Description**	This is a connection-less protocol: user data can be sent without first building a session. Examples of such applications are SNMP and TFTP. Although TFTP is session-oriented, it builds the session at a higher level and uses UDP for its simplicity as transport protocol. The UDP header contains a *port* field indicating the higher-layer protocol.
	Action	The source port number is replaced by a specific port number. All traffic from this source IP address / port number pair is assigned this specific port number. If there is no traffic for 5 to 10 minutes, the specific port number is freed. If the session has not been properly closed, the port number is freed 3 minutes after the last session traffic. This time is configurable (refer to telindus1431Router/router/defaultNat/udpSocketTimeOut on page 490).

Protocol		
ICMP	**Description**	This is a connection-less protocol: user data can be sent without first building a session. An example of such an application is ping. These protocols do not have port numbers.
	Action	Each ICMP packet is forwarded towards the Internet. Each ICMP packet is considered as a new session. If there is no traffic for 5 to 10 minutes, the session is closed. The fact that it is possible to open a total of 2048 simultaneous sessions and that each ICMP packet is considered as a new session, implies that for instance a continuous series of ping requests at a rate of one per second will allocate between 300 and 600 sessions.

Incoming traffic (from the Internet)

Suppose the WAN IP network depicted in 10.7.3 - Enabling PAT on an interface on page 223 works in numbered mode[1]. The incoming traffic from the Internet may be destined either for the local network, or for the router itself. The router treats incoming traffic on the PAT address as follows:


begin
Transport protocol?
ICMP
Echo request?
yes
The route replies on this request.
no
Echo reply?
yes
Search corresponding request and send to originator.
no
Router error message?
yes
Send to originator that caused the error.
no
TCP/UDP
Destination IP address = PAT address AND port number = previously allocated port number for outgoing traffic?
yes
The router forwards the packet after IP address / port number replacement on the local network.
no
Does the PAT address match the IP address of the WAN interface and is this port number known by the router its protocol stack (TMA, Telnet, SNMP, TFTP)?
yes
The router treats the packet as a packet destined for him.
no
Discard the packet.
end

Note that the Telindus 1431 SHDSL CPE only answers to ICMP requests on the public address of its WAN interface if the LAN interface is up. I.e. when the TCP/UDP sessions can really “cross” the Telindus 1431 SHDSL CPE.

1. Numbered mode means that each WAN interface has an IP address. In that case, you need the single official IP address for your WAN interface.

10.7.5 PAT limitations and work-arounds

PAT limitations

Port Address Translation has some limitations:

- Some TCP or UDP applications do not support port translation.
- Only outgoing sessions are supported. This implies that you can not access servers on your local network over the Internet.
- Limited ICMP support.

PAT limitations work-arounds

Use the following attributes to partly overcome the PAT limitations:

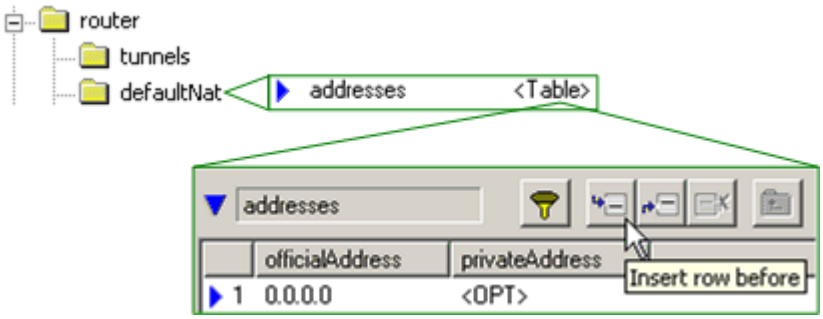
Attribute	Description
portTranslations	You can find this attribute in the router/defaultNat object. Use this attribute to define specific port number ranges that should not be translated when using PAT. Refer to telindus1431Router/router/defaultNat/portTranslations on page 488. **Example - configuring the** portTranslations **table** TMA is an example of an application that does not support port translation. If you want to make TMA connections from your local network to the outside world, you have to list TMA port number 1728 in this table. However, keep in mind that even then it is still not possible to have two simultaneous TMA sessions to the same outside world address. portTranslations protocol / startPort / endPort / action 1 udp 1728 <Opt> no translation 2 udp 2000 3000 deny If you do not want that UDP packets with port numbers in the range 2000 up to 3000 are sent to the outside world, then you also have to include those in the table.
servicesAvailable	You can find this attribute in the router/defaultNat object. Use this attribute to define specific port number ranges for incoming Internet traffic that should not be translated when using PAT. Instead it is sent to the corresponding private IP address. Refer to telindus1431Router/router/defaultNat/servicesAvailable on page 489. **Example - configuring the** servicesAvailable **table** In this example, a web server with address 192.168.47.250 on the local network is accessible from the Internet although it has no official IP address. servicesAvailable protocol / startPort / endPort / serverAddress 1 tcp 80 <Opt> 192.168.47.250

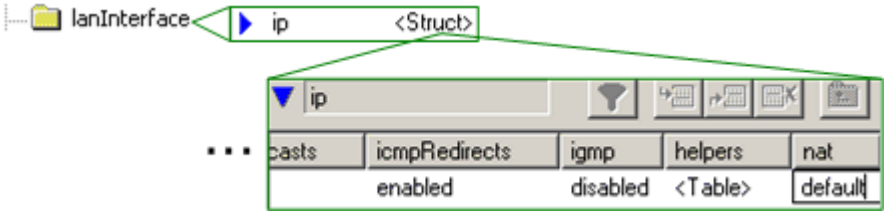
10.7.6 Enabling NAT on an interface

Refer to 10.7.1 - Introducing address translation on page 221 for an introduction on NAT.

Despite the work-arounds offered by the previous two PAT configuration attributes to overcome the limitations of PAT (refer to 10.7.5 - PAT limitations and work-arounds on page 228), there are situations where PAT is inadequate. For example, it is not possible to have several web servers on your local network. It is also impossible to run an application with fixed source port numbers on several local devices that are connected simultaneously to a single Internet device. This can only be solved by using several official IP addresses: Network Address Translation.

To enable NAT on a certain interface, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router/defaultNat object or add your own NAT object under the router object, e.g. router/nat[myNat] (refer to 4.4 - Adding an object to the containment tree on page 49).
2	In the NAT object (default or user instantiated), select the addresses attribute and add one or more entries to this table.  Use this attribute to enter all the official IP addresses that have to be used for Network Address Translation. Entering an address in the addresses table automatically enables the general NAT process. Now you can activate or deactivate NAT per IP interface. Note that by default NAT is deactivated on all IP interfaces.
3	Configure the elements of the addresses table: • officialAddress. Use this element to set the official IP address. These addresses are used in the reverse order as they appear in the list. • privateAddress. Use this element to set the private IP address, i.e. to permanently assign an official IP address to a private address. If you do not specify a private IP address, then NAT is applied dynamically. I.e. the official IP address is used for any private source IP address.
4	In the NAT object (default or user instantiated), configure the gateway attribute. Use this attribute to define the gateway address of routes on which NAT should be applied. If you do not configure the gateway attribute, then NAT is applied on all routes through this interface.

Step	Action
5	Each IP interfaces has an ip structure. Use the following element in the ip structure to activate or deactivate NAT per IP interface: • nat. Use this element to enable address translation on the interface with the official IP addresses. Do this by entering the name of the NAT object you want to apply: - If you want to apply the NAT settings as defined in the router/defaultNat object, then enter the string "default" as value for the nat element. - If you want to apply the NAT settings as defined in a NAT object you added yourself (e.g. router/nat[myNat]), then enter the index name of the NAT object (in this case "myNat") as value for the nat element. For example, the following shows the location of the ip structure on the LAN interface:  Refer to 5.2.2 - Where to find the IP parameters? on page 59 for the location of the ip structure on the different IP interfaces.

Important remark - using NAT on the LAN interface

Consider the following configuration:

- telindus1431Router/lanInterface/ip/address = 195.7.12.22
- telindus1431Router/router/defaultNat/addresses = { officialAddress = 195.7.12.22; privateAddress = <opt> }
- telindus1431Router/wanInterface/ppp/ip/address = 2.2.2.2

The above means that NAT is used on the LAN interface and the router uses the address 195.7.12.22 as official IP address.

The problem that arises here is that the router can no longer be managed via the LAN interface using the management tool (TMA, Telnet, etc.). This because the NAT route has priority over the LAN route and, because it is a NAT address, the router does not accept incoming traffic on the address 195.7.12.22.

The solution is to add the WAN IP address to the addresses table as private address: telindus1431Router/router/addresses = { officialAddress = 195.7.12.22; privateAddress = 2.2.2.2 }. In that case, the management tool "service" runs on the WAN IP address. This means however, that the WAN has to be up.

10.7.7 Adding multiple NAT objects

It is possible to add multiple NAT objects (up to 5). This means that up to 5 interfaces can make use of a dedicated NAT object.

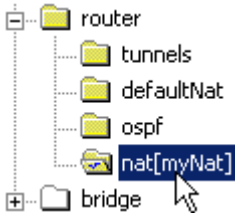
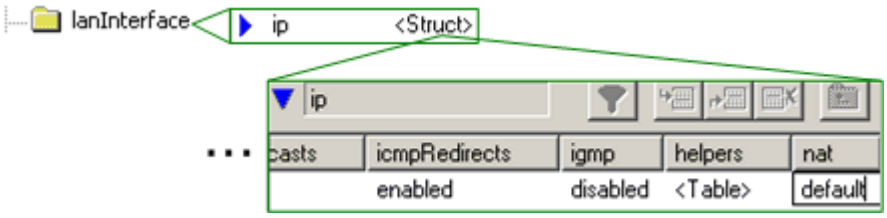
Two or more interfaces pointing to one and the same NAT object is an invalid configuration of which the result is unpredictable.

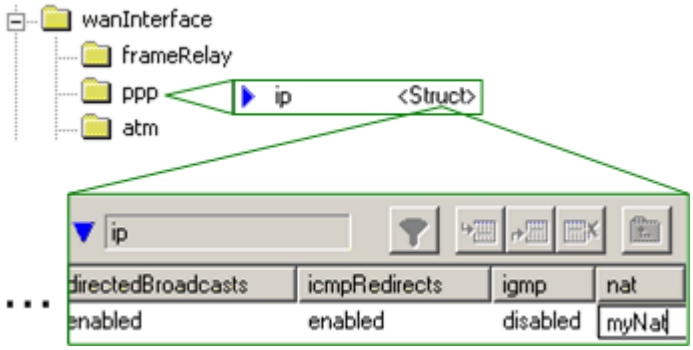
Example

Suppose on a Telindus 1421 SHDSL Router you …

- want to have 2 NAT objects: the default NAT object (router/defaultNat) and a user instantiated NAT object (e.g. router/nat[myNat]).
- want to apply the default NAT object on the LAN interface and the user instantiated NAT object on the WAN interface (and the WAN interface uses, for example, PPP).

Proceed as follows:

Step	Action
1	In the Telindus 1421 SHDSL Router containment tree, go to the router/defaultNat object and configure the attributes in this object to your needs. Refer to 14.9.2 - NAT configuration attributes on page 487.
2	In the Telindus 1421 SHDSL Router containment tree, go to the router object an add a nat object underneath. E.g. router/nat[myNat]. Refer to 4.4 - Adding an object to the containment tree on page 49. 
3	Configure the attributes in the router/nat[myNat] object to your needs. Refer to 14.9.2 - NAT configuration attributes on page 487.
4	In the Telindus 1421 SHDSL Router containment tree, go to the lanInterface object and select the ip structure. In the nat element of the ip structure enter the string “default”.  ⇒The NAT settings as defined in the router/defaultNat object are applied on the LAN interface.

Step	Action
5	In the Telindus 1421 SHDSL Router containment tree, go to the wanInterface/ppp object and select the ip structure. In the nat element of the ip structure enter the string "myNat".  ⇒The NAT settings as defined in the router/nat[myNat] object are applied on the WAN interface.

10.7.8 How does NAT work?

Dynamically assigning official IP address

If a local station sends data to the Internet for the first time, NAT looks for an unused official IP address. It assigns this official IP address to the local station. The amount of local stations that can have simultaneous Internet access equals the amount of NAT addresses you defined. If all sessions between a local station and the Internet have been closed by the application (in case of TCP) or because of time-outs, then the previously assigned official IP address is freed for another local station.

Statically assigning official IP address

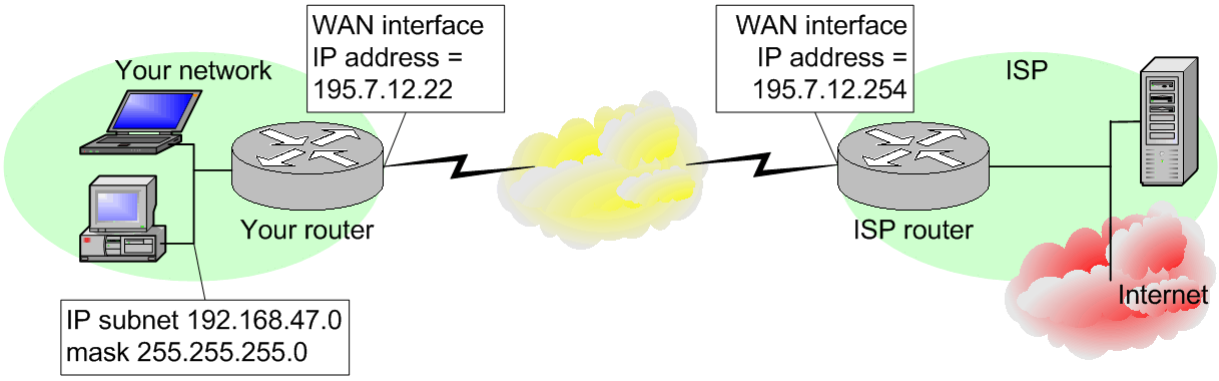
Optionally, the NAT address entry may contain a corresponding private IP address. This allows to permanently assign an official IP address to a local station. This is useful for stations or servers that should have Internet access at all times. Another example of permanently assigned official IP addresses is a network where only a limited number of users has Internet access.

Incoming traffic on an official IP address

NAT only converts IP addresses and thus allows traffic in both directions. However, incoming traffic on one of the official IP addresses can only be forwarded to the local network if a corresponding private IP address has been configured.

Example - configuring NAT

Suppose your network is connected over a network of an operator to an Internet Service Provider (ISP). You received 4 official IP address from you ISP, being 195.7.12.21 up to 195.7.12.24. You want to assign one of these official addresses permanently to a web server which has private address 192.168.47.250. All other official addresses have to be assigned dynamically.



The following shows how to enable NAT:

- In the router/defaultNat object, configure the addresses attribute as follows:

addresses

	officialAddress	privateAddress
1	195.7.12.21	192.168.47.250
2	195.7.12.22	<OPT>
3	195.7.12.23	<OPT>
4	195.7.12.24	<OPT>

- In the router/defaultNat object, set the gateway attribute to 195.7.12.254. If, however, you already defined the router/defaultRoute attribute to be 195.7.12.254, then you can leave the gateway attribute empty. This because if the gateway attribute is empty, then the defaultRoute attribute is taken as only gateway addresses.
- In the ip structure of the WAN interface, type the string “default” as value of the nat element.

10.7.9 Combining PAT and NAT

It is possible to use a combination of PAT and NAT. In that case the router first assigns NAT addresses until they are all used. Then it uses PAT addresses for further translations.

Make sure the PAT address does not appear in the NAT address table.

10.7.10 Easy NAT on PPP

What is easy NAT on PPP?

Easy NAT on PPP means that in a typical client / ISP setup NAT will automatically be enabled without the need to specifically configure NAT.

A typical client / ISP setup would be, for example, a Telindus 1421 SHDSL Router on the client side and a Telindus 2400 on the ISP side connected over an SHDSL line.

What are the conditions for easy NAT on PPP?

The conditions for easy NAT on PPP are:

- A PPP (or PPPoA) connection between ISP and client.
- PPP interface on ISP router:
  - The mode is routing.
  - A local IP address may be configured, or it may be coming from the LAN (unnumbered).
  - A remote IP address is imposed on the client router.
  - NAT is disabled.
- PPP interface on client router:
  - The mode is routing.
  - No local nor remote IP address is configured.
  - NAT is enabled (a reference is made to the defaultNat object).
- The defaultNat object on the client router:
  - No PAT address is configured.
  - No NAT address(es) is (are) configured.

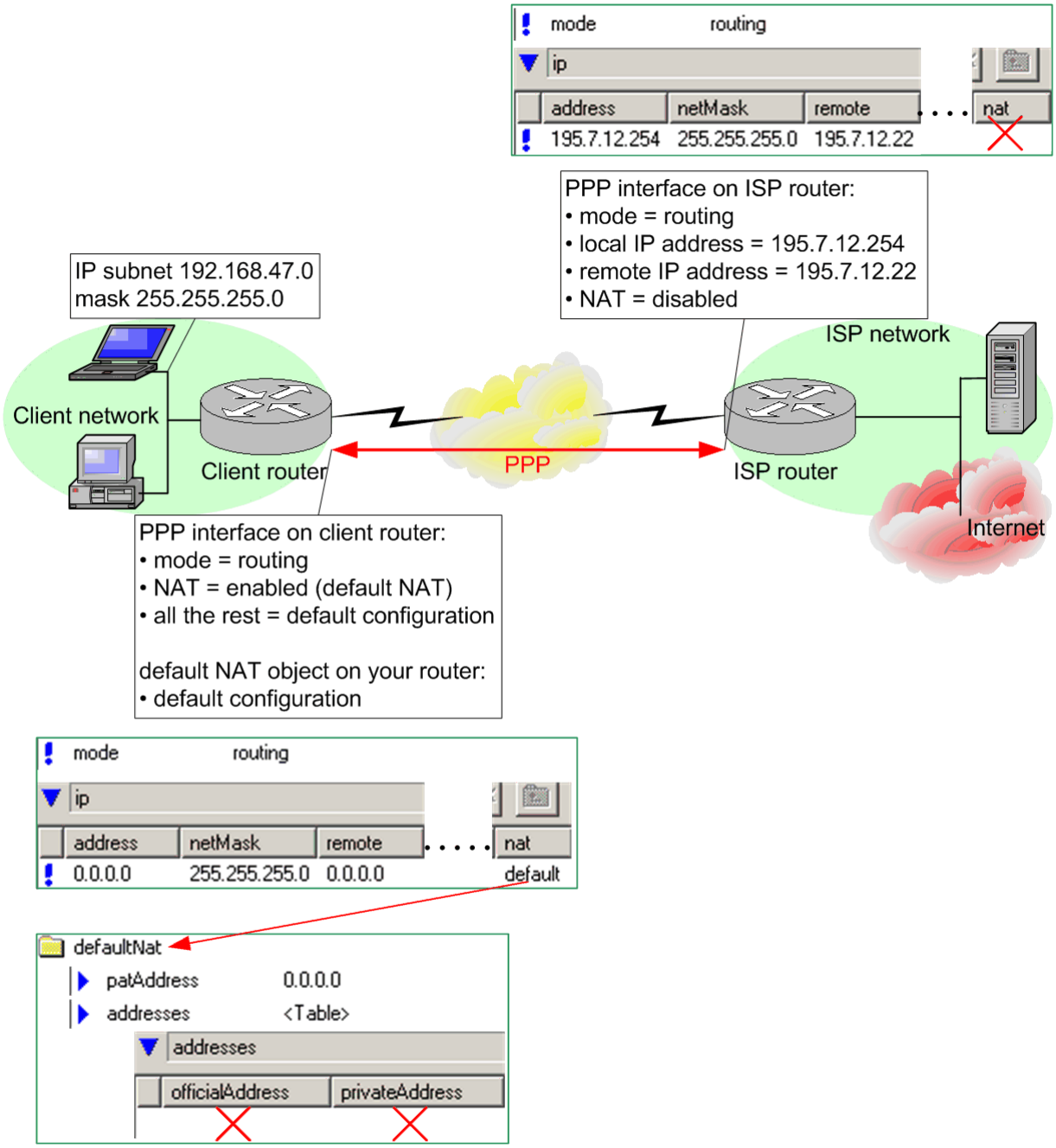
What does easy NAT on PPP?

Once the conditions as stated above are met, the following happens:

- The client router learns the local and remote IP address of the PPP link from the ISP router.
- The client router adds a route towards the ISP router.
- The client router enables NAT on the PPP interface.

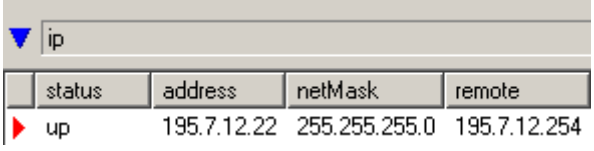
Example - easy NAT

Suppose you have the following setup:

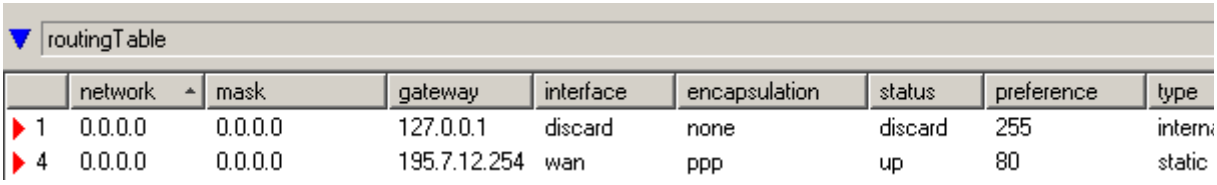


Once the PPP link is up and running, you will see that …

- the client router learns the local and remote IP address of the PPP link from the ISP router. You can check this by looking at the IP status of the PPP link:



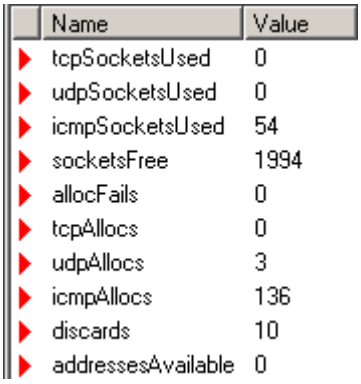
- The client router adds a route towards the ISP router. You can check this by looking at the routing table status:



routingTable

	network	mask	gateway	interface	encapsulation	status	preference	type
1	0.0.0.0	0.0.0.0	127.0.0.1	discard	none	discard	255	intern
4	0.0.0.0	0.0.0.0	195.7.12.254	wan	ppp	up	80	static

- The client router enables NAT on the PPP interface. You can check this by looking at the NAT performance. When a connection to the ISP is active, you will see that socketsFree attribute decreases while the used sockets (xxxSocketsUsed) and allocation (xxxAllocs) attributes increase.



Name	Value
tcpSocketsUsed	0
udpSocketsUsed	0
icmpSocketsUsed	54
socketsFree	1994
allocFails	0
tcpAllocs	0
udpAllocs	3
icmpAllocs	136
discards	10
addressesAvailable	0

10.8 Configuring traffic and priority policy on the router

This section introduces traffic and priority policy and gives a short description of the attributes you can use to configure these features on the router. It also shows you the difference with the traffic policy on the bridge.

The following gives an overview of this section:

- 10.8.1 - Introducing traffic and priority policy on page 239
- 10.8.2 - Traffic and priority policy on routed and on bridged data on page 243
- 10.8.3 - How to configure a traffic and priority policy on the router? on page 244
- 10.8.4 - Creating a traffic policy on the router on page 245
- 10.8.5 - Applying a traffic policy on an interface of the router on page 247
- 10.8.6 - Creating a priority policy on page 248
- 10.8.7 - Applying a priority policy on an interface on page 250
- 10.8.8 - Configuring a traffic and priority policy on the router - an example on page 251

10.8.1 Introducing traffic and priority policy

What is traffic and priority policy?

Because of the bursty nature of voice / video / data traffic, sometimes the amount of traffic exceeds the speed of a link. At this point, the Telindus 1431 SHDSL CPE has to decide what to do with this “excess” of traffic:

- Buffer the traffic in a single queue and let the first packet in be the first packet out?
- Or put packets into different queues and service certain queues more often (also known as priority queuing)?

These questions are dealt with by the traffic and priority policy mechanisms:

- The traffic policy determines, on traffic overload conditions, how and which queues are filled with the “excess” data.
- The priority policy determines how and which queues are emptied.

What is a priority queuing?

Using the traffic and priority policy features you can perform priority queuing. This allows you to define how traffic is prioritised in the network. E.g. to ensure that voice, video or other streaming media is serviced before (or after) other traffic types, to ensure that web response traffic is routed before normal web browsing traffic, etc.

Per interface (both physical and logical), there are 7 queues:

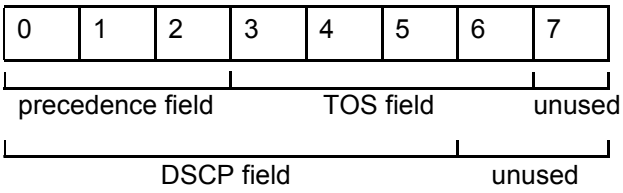
Queue	Queue type	Description
1 - 5	user configurable queue	The user can decide which data goes into which queue.
6	low delay queue	The user can decide which data goes into this queue. This queue usually is addressed more often then the user configurable queues.
7	system queue	This queue is filled with mission critical data (e.g.link monitoring messages etc.) and has priority over all other queues.

What is DiffServ?

Differentiated Services (DiffServ) differentiates between multiple traffic flows. So, packets are marked, and routers and switches can then make decisions based on those markings (e.g., dropping or forwarding decisions). You can mark packets either with IP Precedence or Differentiated Service Code Point (DSCP) markings.

What is the TOS byte?

The Type Of Service (TOS) byte is an eight bit field inside an IPv4 header. Using these bits you can mark packets either with IP Precedence or Differentiated Service Code Point (DSCP) markings. The TOS byte is structured as follows:



What is IP Precedence?

IP Precedence uses the precedence bits (3 leftmost bits) of the TOS byte (see RFC 791). So IP Precedence markings can range from 0 to 7. However, values 6 and 7 should not be used since they are reserved for network use. IP precedence is being phased out in favour of DSCP, but is supported by many applications and routers.

What is DSCP?

Differentiated Services Code Point (DSCP) uses the DSCP bits (6 leftmost bits) of the TOS byte (see RFC 2474). This offers a bigger granularity over IP Precedence, since 6 bits yield 64 possible values (0 to 63)[1]. The problem with so many values is that the value you choose to represent a certain level of priority can be treated differently by a router under someone else's administration.

To maintain relative levels of priority among devices, the Internet Engineering Task Force (IETF) selected a subset of those 64 values for use. These values are called per-hop behaviours (PHBs), because they indicate how packets should be treated by each router hop along the path from the source to the destination.

The four categories of PHBs are:

- Best Effort (BE)
- Expedited Forwarding (EF)
- Assured Forwarding (AF)
- Class Selector (CS)

1. This also means that DSCP is not compatible with IP Precedence.

What is BE PHB?

Best Effort Per-Hop Behaviour (BE PHB) means that all DSCP bits are 0 (i.e. a DSCP value of 0).

Best Effort does not truly provide QoS, because there is no reordering of packets. Best Effort uses the first-in first-out (FIFO) queuing strategy, where packets are emptied from a queue in the same order in which they entered it.

What is EF PHB?

Expedited Forwarding Per-Hop Behaviour (EF PHB, see RFC 3246) has a DSCP value of 46. Latency-sensitive traffic, such as voice, typically has an EF PHB.

What is AF PHB?

Assured Forwarding Per-Hop Behaviour (AF PHB, see RFC 2597) is the broadest category of PHBs. These are shown in the following table:

AF PHB	Low drop preference	Medium drop preference	High drop preference
class 1	AF11 (10) 001010	AF12 (12) 001100	AF13 (14) 001110
class 2	AF21 (18) 010010	AF22 (20) 010100	AF23 (22) 010110
class 3	AF31 (26) 011010	AF32 (28) 011100	AF33 (30) 011110
class 4	AF41 (34) 100010	AF42 (36) 100100	AF43 (38) 100110

Note that the AF PHBs are grouped into four classes. Within each AF PHB class there are three distinct values which indicate a packet's *drop preference*. Higher values in an AF PHB class are more likely to be discarded during periods of congestion. For example, an AF13 packet is more likely to be discarded than an AF11 packet.

Note that since IP Precedence only examines the 3 leftmost bits, all AF PHB class 1 values would be interpreted by an IP Precedence aware router as an IP Precedence value of 1, AF PHB class 2 values as an IP Precedence value of 2, etc.

What is CS PHB?

Class Selector Per-Hop Behaviour (CS PHB, see RFC 2474) is used for backward compatibility with IP Precedence. This because, just like IP Precedence, CS PHB only examines the 3 leftmost bits of the TOS byte.

What is the TOS field?

The TOS field is a four bit field in the TOS byte (see RFC 1349). Refer to What is the TOS byte? on page 240. The TOS field lets values from 0 to 15 be assigned to request special handling of traffic (for example, minimize delay, maximize throughput). The TOS field is being phased out in favour of DSCP.

What is IEEE 802.1P or COS?

The IEEE 802.1P signalling technique (also often referred to as Class Of Service, COS) is an IEEE endorsed specification for prioritising network traffic at the datalink/MAC sub-layer (layer 2).

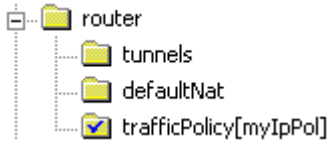
802.1P is a spin-off of the 802.1Q (VLAN tagging) standard and they work in tandem. The 802.1Q standard specifies a tag that appends to a MAC frame. The VLAN tag carries VLAN information. The VLAN tag has two parts: The VLAN ID (12-bit) and prioritisation (3-bit). The prioritisation field was never defined in the VLAN standard. The 802.1P implementation defines this prioritisation field.

10.8.2 Traffic and priority policy on routed and on bridged data

Refer to 10.8.1 - Introducing traffic and priority policy on page 239 for an introduction.

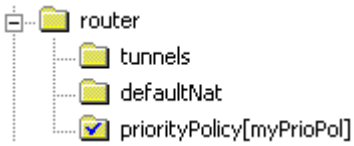
Traffic policy on routed and on bridged data

The traffic policy (i.e. the policy to fill the queues) is not the same for routed data as the one for bridged data. The following table clarifies this:

In case … is enabled,	then …
only routing	the routed data is queued using the traffic policy settings as configured in the trafficPolicy[ ] object under the router object. Refer to 10.8.4 - Creating a traffic policy on the router on page 245. 
only bridging	the bridged data is queued using the traffic policy settings as configured in the trafficPolicy[ ] object under the bridge object. Refer to 11.3.2 - Configuring a traffic policy on the bridge on page 285.
routing and bridging	• the routed data is queued using the traffic policy settings as configured in the trafficPolicy[ ] object under the router object. • the bridged data is queued using the traffic policy settings as configured in the trafficPolicy[ ] object under the bridge object.

Priority policy on routed and on bridged data

The priority policy (i.e. the policy to empty the queues) is the same for routed and bridged data. The queues are emptied using the priority policy settings as configured in the priorityPolicy[ ] object under the router object.



Refer to 10.8.6 - Creating a priority policy on page 248.

10.8.3 How to configure a traffic and priority policy on the router?

Refer to 10.8.1 - Introducing traffic and priority policy on page 239 for an introduction.

To configure a traffic and priority policy for the routed data on a certain interface, proceed as follows:

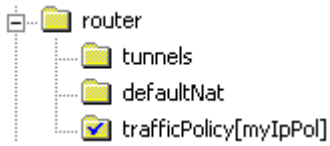
Step	Action
1	Create and configure a routing traffic policy. Refer to 10.8.4 - Creating a traffic policy on the router on page 245.
2	Apply the routing traffic policy on the desired interface. Refer to 10.8.5 - Applying a traffic policy on an interface of the router on page 247.
3	Create and configure a priority policy. Refer to 10.8.6 - Creating a priority policy on page 248.
4	Apply the priority policy on the desired interface. Refer to 10.8.7 - Applying a priority policy on an interface on page 250.

10.8.4 Creating a traffic policy on the router

Refer to 10.8.3 - How to configure a traffic and priority policy on the router? on page 244 for an overview on how to configure a traffic and priority policy. To give you an idea of where you are in the process, the following also gives a quick overview:

- → **Create and configure a routing traffic policy. ← You are here.**
- Apply the routing traffic policy on the desired interface.
- Create and configure a priority policy.
- Apply the priority policy on the desired interface.

To create and configure a traffic policy for the routed data on a certain interface, proceed as follows:

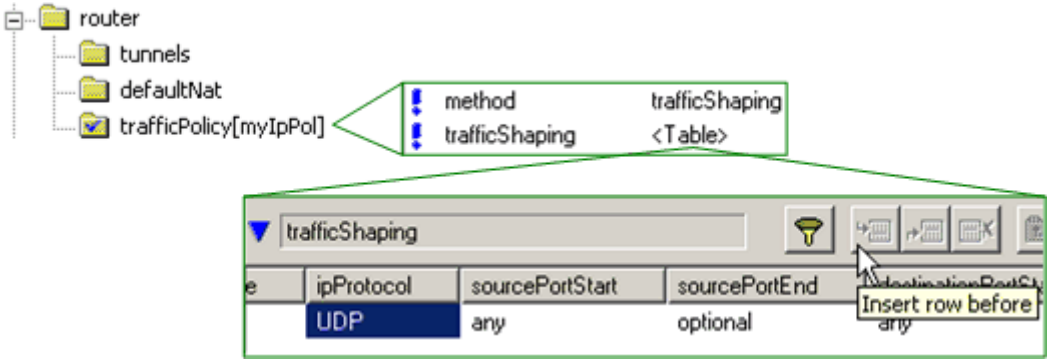
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>In the Telindus 1431 SHDSL CPE containment tree, go to the router object and add a trafficPolicy[ ] object underneath (refer to 4.4 - Adding an object to the containment tree on page 49).
 
</td></tr>
<tr><td>2</td><td>In the traffic policy object you just added, go to the method attribute. Use this attribute to choose a traffic policy method. This traffic policy is then used to determine, on traffic overload conditions, how and which queues are filled with the “excess” data.

Refer to telindus1431Router/router/trafficPolicy[ ]/method on page 520 for more information.</td></tr>
<tr><td>3</td><td>Now, depending on which traffic policy method you selected, you have to configure the actual policy criteria:
<table>
<tr><th>If you choose the method …</th><th>then use the following attribute to configure the policy criteria:</th></tr>
<tr><td>trafficShaping,</td><td>• trafficShaping.
• dropLevels (only the dropLevel1 element).</td></tr>
<tr><td>tosDiffServ,</td><td>dropLevels.</td></tr>
<tr><td>tosMapped,</td><td>• tos2QueueMapping.
• dropLevels (only the dropLevel1 element).</td></tr>
</table>
For more information, refer to …
• telindus1431Router/router/trafficPolicy[ ]/trafficShaping on page 521.
• telindus1431Router/router/trafficPolicy[ ]/dropLevels on page 524.
• telindus1431Router/router/trafficPolicy[ ]/tos2QueueMapping on page 526.</td></tr>
</table>

Example - creating a traffic policy on the router

Suppose you create a traffic policy which uses the traffic shaping method to fill the queues, on traffic overload conditions, with the “excess” data. Suppose you want to do this for the UDP protocol only.

The following figure shows how to configure this:



10.8.5 Applying a traffic policy on an interface of the router

Refer to 10.8.3 - How to configure a traffic and priority policy on the router? on page 244 for an overview on how to configure a traffic and priority policy. To give you an idea of where you are in the process, the following also gives a quick overview:

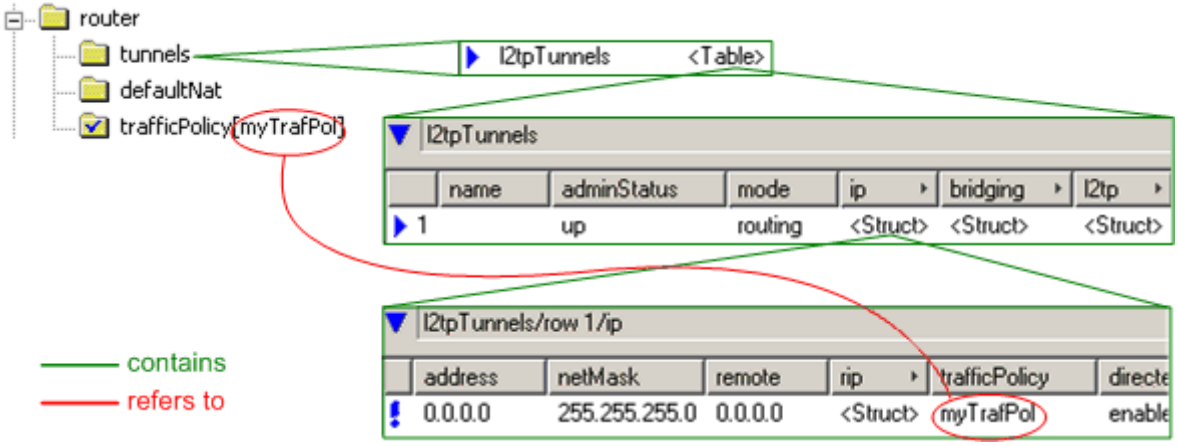
- Create and configure a routing traffic policy.
- → **Apply the routing traffic policy on the desired interface.** ← **You are here.**
- Create and configure a priority policy.
- Apply the priority policy on the desired interface.

To apply a traffic policy for the routed data on a certain interface, enter the index name of the earlier created traffic policy object as value of the trafficPolicy element. The trafficPolicy element can be found in the ip structure of the IP interface. Refer to 5.2.2 - Where to find the IP parameters? on page 59 for the location of the ip structure on the different IP interfaces.

Example - applying a traffic policy on an interface of the router

Suppose you created and configured a traffic policy object with index name myTrafPol (i.e. trafficPolicy[myTrafPol]), and you want to apply this traffic policy on an L2TP tunnel you created earlier.

The following figure shows how to configure this:



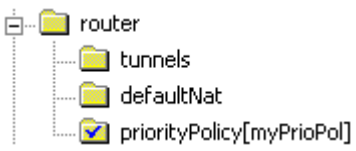
10.8.6 Creating a priority policy

Whereas configuring a traffic policy for routed data is different than for bridged data, configuring a priority policy is the same for both. In other words, the mechanism to fill the queues is different for routed data than it is for bridged data, but the mechanism to empty the queues is the same for both routed and bridged data.

Refer to 10.8.3 - How to configure a traffic and priority policy on the router? on page 244 for an overview on how to configure a traffic and priority policy. To give you an idea of where you are in the process, the following also gives a quick overview:

- Create and configure a traffic policy.
- Apply the traffic policy on the desired interface.
- → **Create and configure a priority policy.** ← **You are here.**
- Apply the priority policy on the desired interface.

To create and configure a priority policy for a certain interface, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and add a priorityPolicy[ ] object underneath (refer to 4.4 - Adding an object to the containment tree on page 49). 
2	In the priority policy object you just added, go to the algorithm attribute. Use this attribute to determine how and which queues are emptied. Refer to telindus1431Router/router/priorityPolicy[ ]/algorithm on page 528 for more information.
3	Configure the other attributes in the priority policy object. The most important are: • queueConfigurations. Use this attribute to … - set the number of bytes/packets that is dequeued from the user configurable queue when the queue is addressed. - set the relative importance of the user configurable queues. Refer to telindus1431Router/router/priorityPolicy[ ]/queueConfigurations on page 530 for more information. • lowDelayQuotum. Use this attribute to set the number of bytes/packets that is dequeued from the low delay queue when the queue is addressed. Refer to telindus1431Router/router/priorityPolicy[ ]/lowdelayQuotum on page 530 for more information. • bandwidth. Use this attribute to set the Committed Information Rate (CIR) per queue. Refer to telindus1431Router/router/priorityPolicy[ ]/bandwidth on page 531 for more information.

Example - creating a traffic policy on the router

Suppose you create a priority policy which uses the round-robin algorithm to empty the queues.

The following figure shows how to configure this:

10.8.7 Applying a priority policy on an interface

Refer to 10.8.3 - How to configure a traffic and priority policy on the router? on page 244 for an overview on how to configure a traffic and priority policy. To give you an idea of where you are in the process, the following also gives a quick overview:

- Create and configure a traffic policy.
- Apply the traffic policy on the desired interface.
- Create and configure a priority policy.
- → **Apply the priority policy on the desired interface.** ← **You are here.**

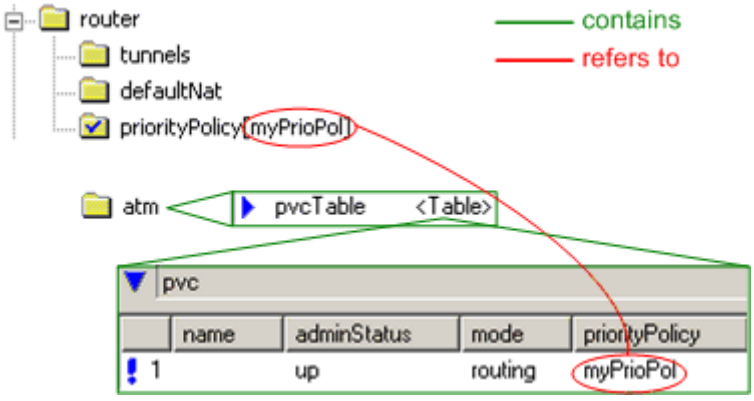
To apply a priority policy on a certain interface, enter the index name of the earlier created priorityPolicy[ ] object as value of the priorityPolicy attribute. The priorityPolicy attribute can be found in …

- telindus1431Router/lanInterface/priorityPolicy. So in this case you specify a priority policy for the LAN interface.
- telindus1431Router/wanInterface/priorityPolicy. So in this case you specify a priority policy for the complete WAN interface (i.e. also for all logical interfaces that are present on the WAN interface, such as ATM PVCs, etc.).
- telindus1431Router/wanInterface/atm/pvcTable/priorityPolicy. So in this case you can specify a priority policy for each ATM PVC.

Example - applying a priority policy on an interface

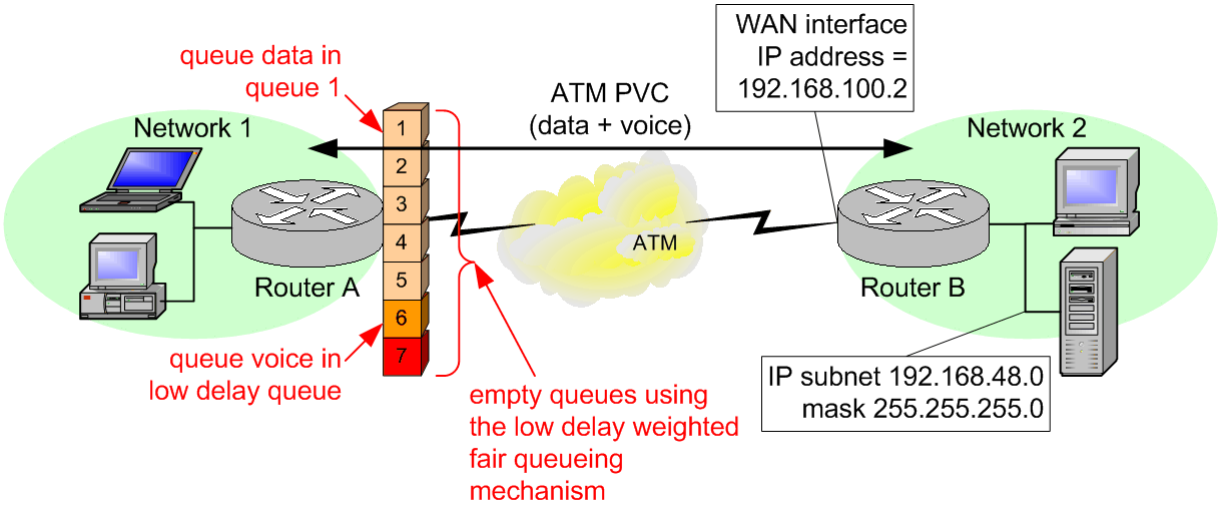
Suppose you created and configured a priority policy object with index name myPrioPol (i.e. priorityPolicy[myPrioPol]), and you want to apply this priority policy on an ATM PVC profile you created earlier.

The following figure shows how to configure this:



10.8.8 Configuring a traffic and priority policy on the router - an example

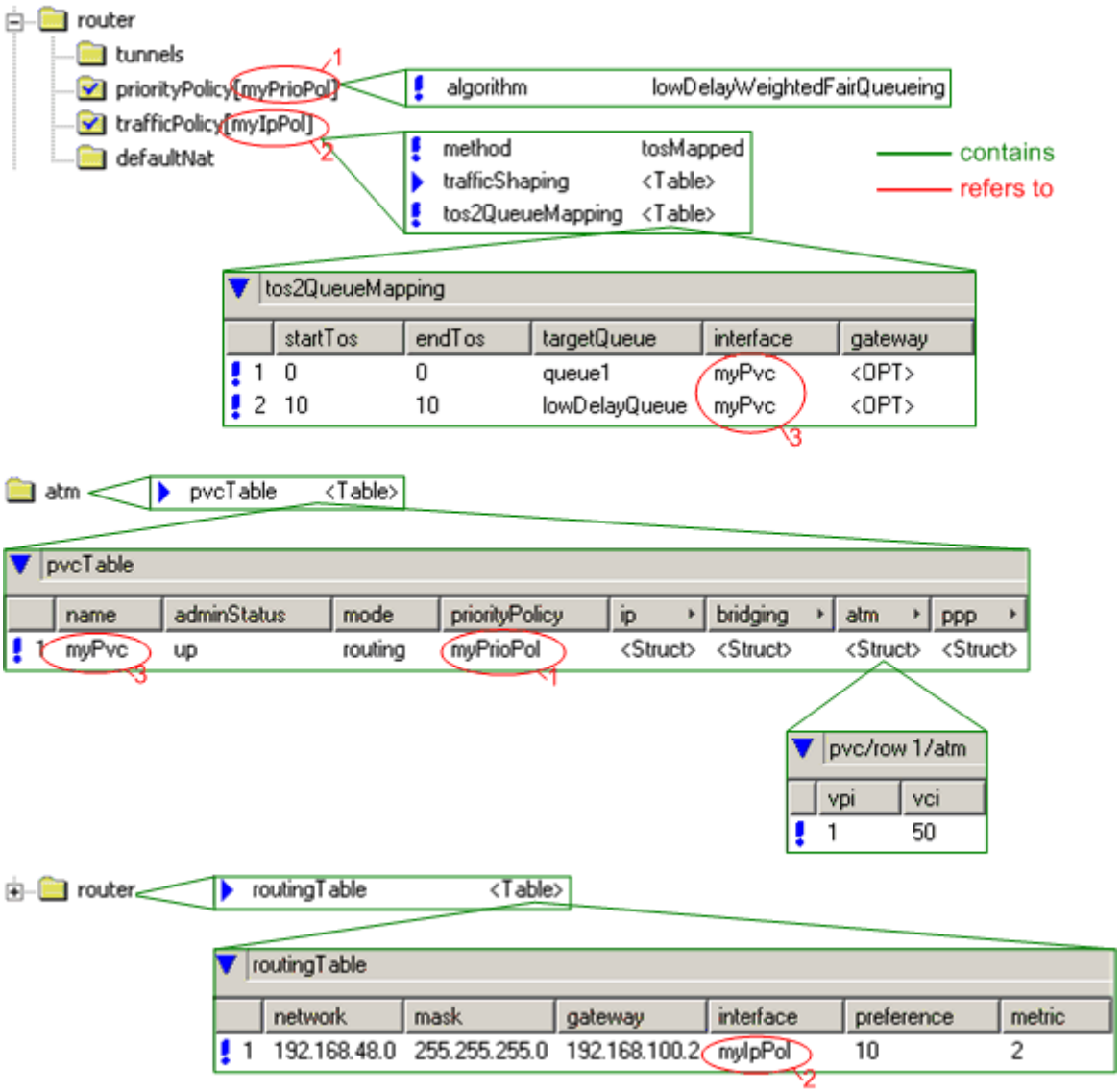
Suppose you have two networks which are interconnected over an ATM network. Network 1 carries a mix of data and voice traffic. The traffic on this network is differentiated by setting the Type Of Service (TOS) values in the IP packet headers (data = 0, voice = 10). If congestion occurs when routing the traffic from network 1 to network 2, then you want that the voice traffic is queued in the low delay queue and that the data traffic is queued in queue 1. The algorithm that you want to use to empty the queues is the low delay weighted fair queueing mechanism.



Sketched in broad outlines, this is how you configure the above:

Step	Action
1	Create and configure an IP traffic policy and a priority policy. For example: • Create a trafficPolicy[myIpPol] object. • Set the method attribute to tosMapped. • In the tos2QueueMapping structure, create two entries and define the startTos, endTos and interface elements of each entry. Also set the targetQueue for both types of traffic: - the low delay queue for the voice. - queue 1 for the data. • Create a priorityPolicy[myPrioPol] object and set the algorithm attribute to lowDelayWeighted-FairQueueing.
2	Set up the ATM PVC. Since this is not the main subject of this example, refer for more information on setting up an ATM PVC to 9.1.3 - Configuring ATM PVCs (IP LAN PVC) on page 140.
3	Create a route that “points” to the traffic policy you created earlier. For example: Create an entry in the routingTable attribute in which you specify that traffic destined for network 192.168.48.0 has to be sent to the IP traffic policy you created earlier.

The following figure shows how to configure the traffic and priority policy you want to set up:



10.9 Configuring VRRP

This section introduces the Virtual Router Redundancy Protocol (VRRP) and gives a short description of the attributes you can use to configure VRRP.

The following gives an overview of this section:

- 10.9.1 - Introducing VRRP on page 254
- 10.9.2 - Setting up VRRP on page 256

10.9.1 Introducing VRRP

What is VRRP?

VRRP is designed to eliminate the single point of failure inherent in the static default routed environment. VRRP specifies an election protocol that dynamically assigns responsibility for a virtual router to one of the VRRP routers on a LAN. The VRRP router controlling the IP address(es) associated with a virtual router is called the Master, and forwards packets sent to these IP addresses. The election process provides dynamic fail-over in the forwarding responsibility should the Master become unavailable. Any of the virtual router's IP addresses on a LAN can then be used as the default first hop router by end-hosts. The advantage gained from using VRRP is a higher availability default path without requiring configuration of dynamic routing or router discovery protocols on every end-host.

What is a VRRP router?

A router running VRRP. It may participate in one or more virtual routers.

What is a virtual router?

An abstract object managed by VRRP that acts as a default router for hosts on a shared LAN. It consists of a Virtual Router Identifier and a set of associated IP address(es) across a common LAN. A VRRP router may backup one or more virtual routers.

What is a master virtual router?

The VRRP router that is assuming the responsibility of forwarding packets sent to the IP address(es) associated with the virtual router, and answering ARP requests for these IP addresses. Note that if the IP address owner is available, then it will always become the master.

What is a backup virtual router?

The set of VRRP routers available to assume forwarding responsibility for a virtual router should the current master fail.

What is a VRRP IP address owner?

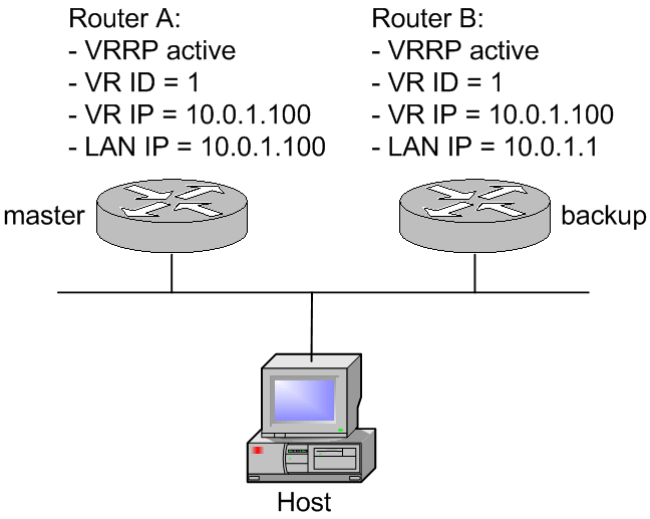
The VRRP router that has the virtual router's IP address(es) as real interface address(es). This is the router that, when up, will respond to packets addressed to one of these IP addresses for ICMP pings, TCP connections, etc.

What is a VRRP primary IP address?

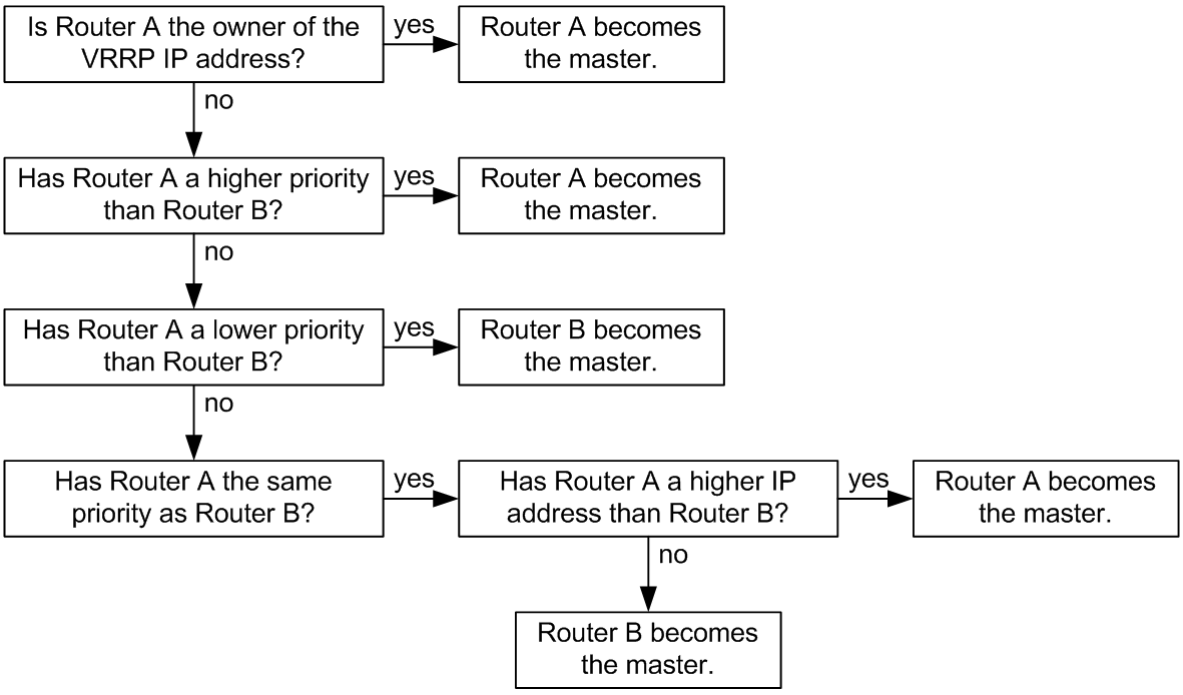
An IP address selected from the set of real interface addresses. One possible selection algorithm is to always select the first address. VRRP advertisements are always sent using the primary IP address as the source of the IP packet.

How is a master virtual router elected?

In a VRRP set-up as shown below, there is one master virtual router and one (or more) backup virtual router.



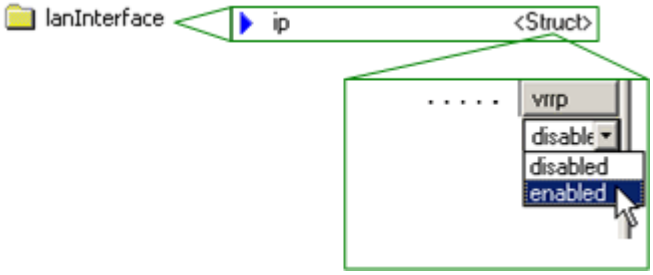
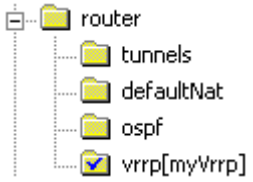
The following shows how the master is elected:


Is Router A the owner of the VRRP IP address?
yes
Router A becomes the master.
no
Has Router A a higher priority than Router B?
yes
Router A becomes the master.
no
Has Router A a lower priority than Router B?
yes
Router B becomes the master.
no
Has Router A the same priority as Router B?
yes
Has Router A a higher IP address than Router B?
yes
Router A becomes the master.
no
Router B becomes the master.

10.9.2 Setting up VRRP

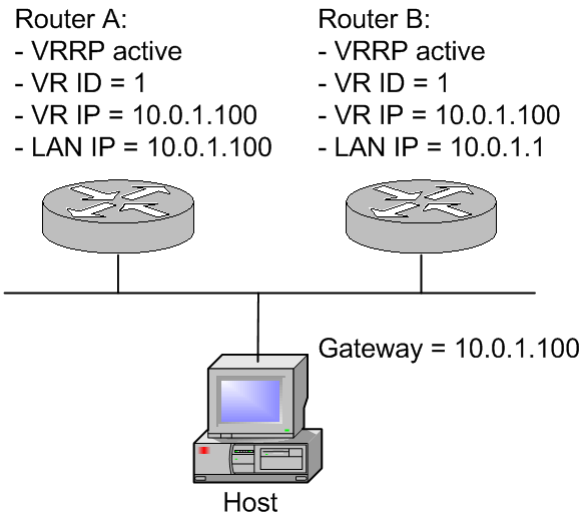
Refer to 10.9.1 - Introducing VRRP on page 254 for an introduction on VRRP.

To set up VRRP, proceed as follows:

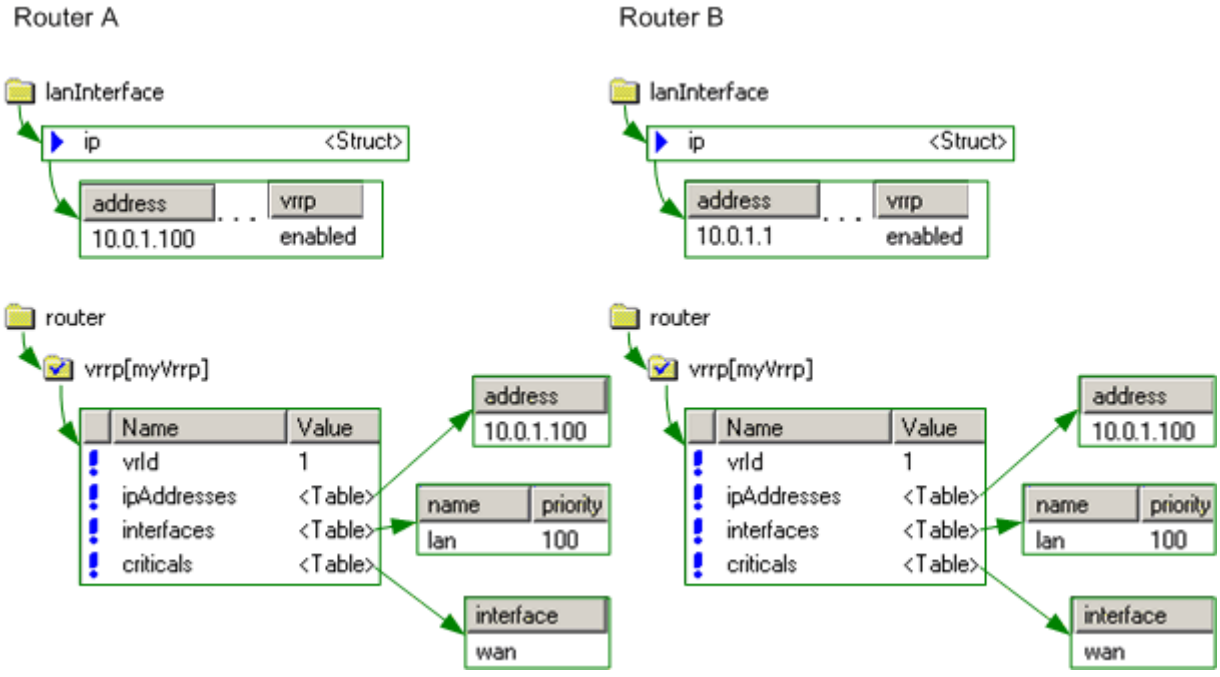
Step	Action
1	Enable VRRP on the interface(s) of your choice. Do this by setting the vrrp element in the ip structure of the interface to enabled. For example, if you want to enable VRRP on the LAN interface, then proceed as follows: 1. In the containment tree of the Telindus 1431 SHDSL CPE, select the configuration structure telindus1431Router/lanInterface/ip. 2. In the ip structure, set the element vrrp to enabled. 
2	In the containment tree of the Telindus 1431 SHDSL CPE, go to the router object an add a vrrp object underneath. E.g. router/vrrp[myVrrp]. Refer to 4.4 - Adding an object to the containment tree on page 49. 
3	Configure the virtual router. Do this by configuring the attributes of the vrrp object. The most important attributes are: • vrId. Use this attribute to set the identification of the virtual router. Specify a number between 1 and 255. The VRID has to be set the same on all participating routers. • ipAddresses. Use this attribute to configure one or more IP addresses on the virtual router. • interfaces. Use this attribute to add (IP) interfaces to the virtual router and assign a priority to them. This priority is used in the master virtual router election process. • criticals. Use this attribute to specify which interfaces must be up before a router may be elected as master virtual router. Refer to 14.9.9 - VRRP configuration attributes on page 532 for more information.

Example: VRRP master/backup with owner

Suppose you have two routers configured for VRRP:



Configure this setup as follows:



In the setup above, once Router A is configured for VRRP, it looks at the IP address of the virtual router and compares it with the IP addresses of its own interface that is configured for VRRP on that VRID. Since Router A owns the virtual router's IP address, it declares itself the master and sends out an advertisement to all of the other VRRP routers. The IP address owner is always the master as long as it is available.

The host shown in the setup above is configured with the virtual router's IP address as its default gateway. The master forwards packets destined to remote subnets and responds to ARP requests. Since in this example, the master is also the owner of the virtual router's IP address, it also responds to ICMP ping requests and IP datagrams destined for the virtual router's IP address. The backup does not forward any traffic on behalf of the virtual router, nor does it respond to ARP requests.

If the master (in this case also the IP address owner) is not available, then the backup becomes the master and takes over responsibility for packet forwarding and responding to ARP requests. However, since this new master is not the IP address owner, it does not respond to ICMP ping requests and IP datagrams destined to that address.

Each VRRP Router that is an IP address renter is configured with a priority between 1 and 254. According to the VRRP standard, an owner has a priority of 255.

It is not necessary for the virtual router IP address to be owned by one of the VRRP routers. In that case, however, the election process to determine the master is different. The process involves comparing two criteria:

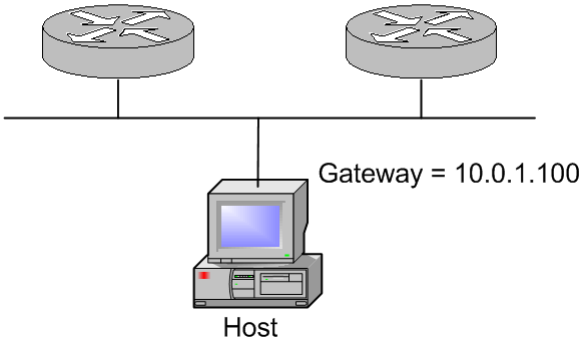
- First, the VRRP router with the highest priority becomes the master.
- Second, if the priorities are the same, then the higher IP address wins and becomes the master.

Example: VRRP master/backup without owner

Suppose you have two routers configured for VRRP:

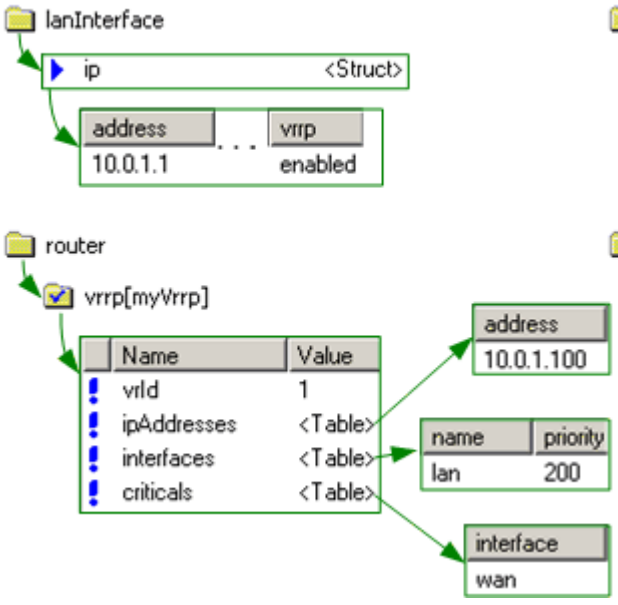
Router A:
- VRRP active
- VR ID = 1
- VR IP = 10.0.1.100
- LAN IP = 10.0.1.1

Router B:
- VRRP active
- VR ID = 1
- VR IP = 10.0.1.100
- LAN IP = 10.0.1.2

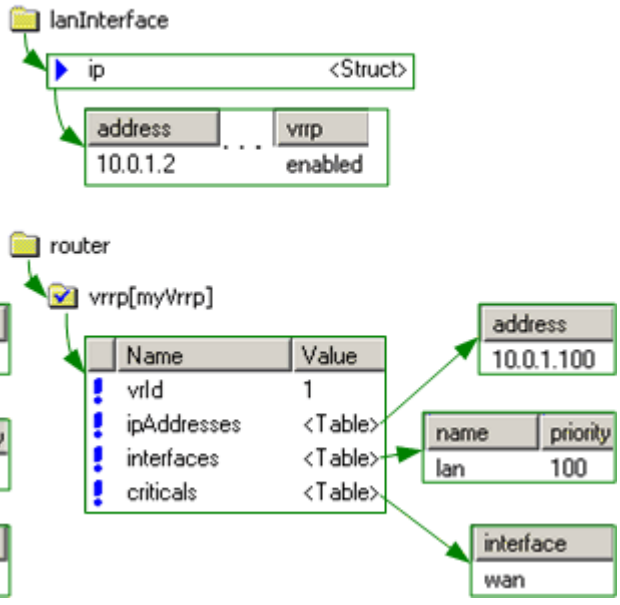


Configure this setup as follows:

Router A



Router B



In this case the VRRP configuration is identical, except for the priority. Router A has its priority set to 200, which when compared to Router B's priority of 100, will ensure that Router A is the master. There is no virtual router IP address owner in this configuration, since neither VRRP router has the virtual router IP address configured on a real interface address. So, both VRRP routers are considered renters.

11 Configuring bridging

This chapter introduces bridging on the Telindus 1431 SHDSL CPE and lists the attributes you can use to configure bridging.

The following gives an overview of this chapter:

- 11.1 - Introducing bridging on page 262
- 11.2 - Configuring bridging on page 272
- 11.3 - Configuring traffic and priority policy on the bridge on page 283

Refer to the Reference manual on page 377 for a complete overview of the attributes of the Telindus 1431 SHDSL CPE.

11.1 Introducing bridging

This section introduces the bridging concept. The following gives an overview of this section:

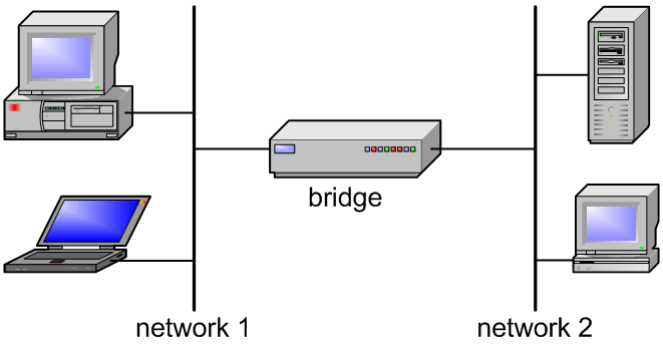
- 11.1.1 - What is bridging? on page 263
- 11.1.2 - The self-learning and Transparent Spanning Tree bridge on page 264
- 11.1.3 - The Spanning Tree root bridge on page 265
- 11.1.4 - The Spanning Tree topology on page 266
- 11.1.5 - The Spanning Tree bridge port states on page 267
- 11.1.6 - The Spanning Tree Bridge Protocol Data Unit on page 268
- 11.1.7 - The Spanning Tree behaviour on page 269
- 11.1.8 - The Spanning Tree priority and cost on page 270

11.1.1 What is bridging?

The Telindus 1431 SHDSL CPE can be configured to act as a bridge. This enables you to split up your LAN network into smaller parts or segments. This decreases the amount of data traffic on the separated LAN segments and, consequently, increases the amount of available bandwidth.

Example

The following figure shows an example of bridging:



Data coming from network 1, will only be let through by the bridge if this data has a destination outside network 1 or if it has a broadcast or multicast address. This means the bridge filters the data and decreases the amount of data traffic on the separated LAN segments.

11.1.2 The self-learning and Transparent Spanning Tree bridge

The Telindus 1431 SHDSL CPE features two bridging mechanisms:

- self-learning bridging,
- self-learning bridging in conjunction with the Transparent Spanning Tree (TST) algorithm, or briefly Spanning Tree bridging.

Bridging principle	Description
self-learning	The bridge learns which data it has to forward to the other LAN segment and which data it has to block. I.e. it builds its own bridging table. In other words, you do not have to configure a bridging table with MAC addresses of stations that are located on the separated LAN segments but that have to be able to communicate with each other.
self-learning + TST	This is based on the self-learning principle, but a protocol is used to implement the TST algorithm. **Bridging loops** The primary goal of this algorithm is to avoid that bridging loops arise. A bridging loop occurs when two self-learning bridges are placed in parallel. This results in data that keeps circling around as each bridge forwards the same data. **The TST algorithm** Using the TST algorithm, bridges know of each others existence. By communicating with each other, they establish one single path for reaching any particular network segment. If necessary, they may decide to disable some bridges in the network in order to establish this single path. This is a continuous process. So if a bridge fails, the remaining bridges will reconfigure their bridging tables keeping each LAN segment reachable.

11.1.3 The Spanning Tree root bridge

What is the root bridge?

Spanning Tree defines a tree with a root bridge and a loop-free path from the root to all bridges in the extended network. The root bridge is the logical centre of the Spanning Tree topology.

Redundant data paths are forced into a stand-by (blocked) state. If a network segment in the spanning tree fails and a redundant path exists, the spanning-tree algorithm recalculates the spanning-tree topology and activates the stand-by path.

How is a root bridge selected?

All bridges in the network participating in Spanning Tree gather information about other bridges in the network. They do this through an exchange of data messages called Bridge Protocol Data Units (BPDUs).

This exchange of messages results in the following phases:

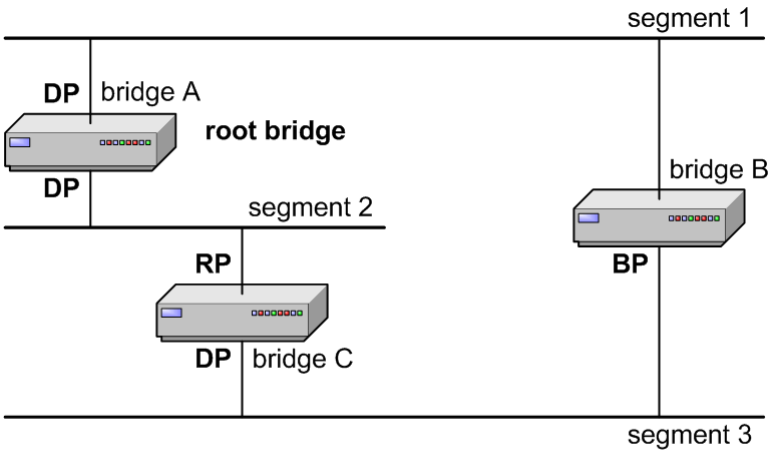
Phase	Description
1	The selection of a root bridge. The bridge with the highest bridge priority (i.e. the lowest numerical priority value) is selected as the root bridge. If all bridges are configured with the default priority (32768), the bridge with the lowest MAC address becomes the root bridge.
2	The selection of a designated bridge for every bridged LAN segment.
3	The removal of loops in the bridged network by blocking bridge ports connected to redundant links.

11.1.4 The Spanning Tree topology

The cost factor is used to calculate the distance from each port of a bridge to the root bridge. On the basis of this, each port on a bridge is assigned one of the following states:

State	Description
root port	The port that is closest to the root bridge. Only one port on each bridge is assigned as the root port.
designated port	The port that connects to bridges further away from the root bridge. The root bridge only has designated ports.
blocking	If a port is not assigned a root port or a designated port state, they are assigned a blocking state. Frames (with the exception of Configuration BPDUs) are not accepted or transmitted by the port when it is in the blocking state. The port can be said to be in stand-by.

An elementary example of a Spanning Tree topology is given in the figure below:



RP = Root Port
DP = Designated Port
BP = Blocking Port

11.1.5 The Spanning Tree bridge port states

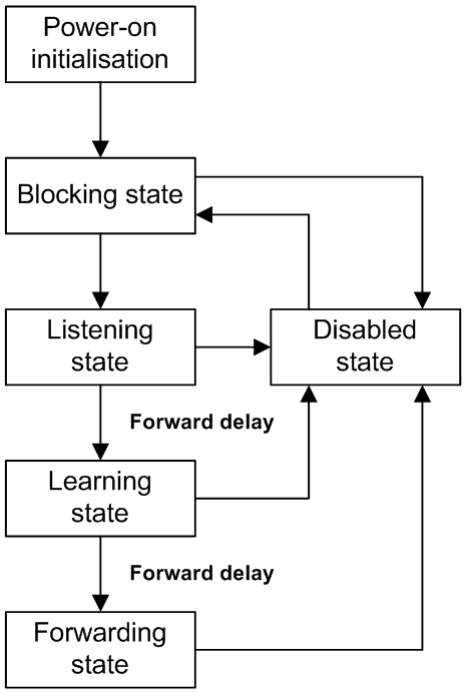
Bridge port states

There are four possible states a bridge port can be in:

State	A port in this state …
blocking	• does no frame forwarding. • does not incorporate station location into its address database (There is no learning on a blocking port, so there is no MAC address database update.). • receives BPDUs, but does not process or propagate them. A bridge always enters the blocking state following bridge initialisation.
listening	• does no frame forwarding. • does not incorporate station location into its address database (There is no learning on a listening port, so there is no MAC address database update.). • receives and processes BPDUs, but does not propagate them.
learning	• does no frame forwarding. • incorporates station location into its MAC address database. • receives, processes and propagates BPDUs.
forwarding	• forwards frames. • incorporates station location into its MAC address database. • receives, processes and propagates BPDUs.

Bridge port state transition diagram

The following figure shows how a bridge port moves through the different states when the bridge is powered:



When you enable Spanning Tree, every bridge in the network goes through the transitory states of listening and learning at power up. If properly configured, each port stabilises to the forwarding or blocking state.

When the spanning-tree algorithm places a port in the forwarding state, the following process occurs:

1. The port is put into the listening state while it waits for protocol information that suggests it should go to the blocking state.
2. The port waits for the expiration of the forward delay timer, moves the port to the learning state, and resets the forward delay timer.
3. In the learning state, the port continues to block frame forwarding as it learns station location information for the forwarding database.
4. The port waits for the expiration of the forward delay timer and then moves the port to the forwarding state, where both learning and forwarding are enabled.

11.1.6 The Spanning Tree Bridge Protocol Data Unit

What is a BPDU?

To establish a stable path, each bridge sends Configuration Bridge Protocol Data Units (BPDUs) to its neighbouring bridges. These Configuration BPDU messages contain information about the spanning tree topology. The contents of these frames only changes when the bridged network topology changes or has not been established.

Each Configuration BPDU contains the following minimal information:

- The unique bridge identifier of the bridge that the transmitting bridge believes to be the root bridge.
- The cost of the path to the root from the transmitting port.
- The unique port identifier of the transmitting port.

When a bridge transmits a BPDU frame, all bridges connected to the LAN on which the frame is transmitted receive the BPDU. When a bridge receives a BPDU, it does not forward the frame. Instead, it uses the information in the frame to:

- calculate a BPDU,
- initiate a BPDU transmission if the topology changes.

The propagation of Configuration BDPUs

When a bridged network is in a stable condition, switches continue to send Configuration BPDUs to its neighbouring bridges at regular intervals. Configuration BPDUs are transmitted down the spanning tree from designated ports to root ports. If a Configuration BPDU is not received by the root port of a bridge within a predefined time interval (for example, because a bridge along the path has dropped out), the port enters the listening state to re-determine a stable path.

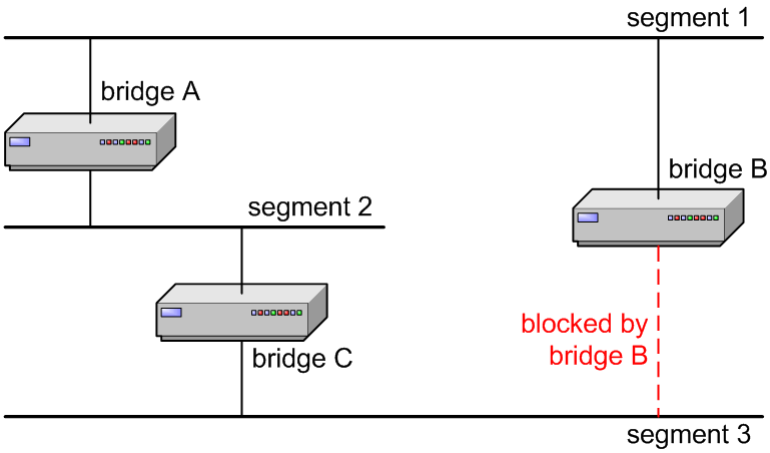
11.1.7 The Spanning Tree behaviour

The following are some examples of how Spanning Tree behaves when certain events occur in your network.

Bridging loops

Bridges connected in a LAN must detect potential bridge loops. They must then remove these loops by blocking the appropriate ports to other bridges.

This is illustrated in the following figure:

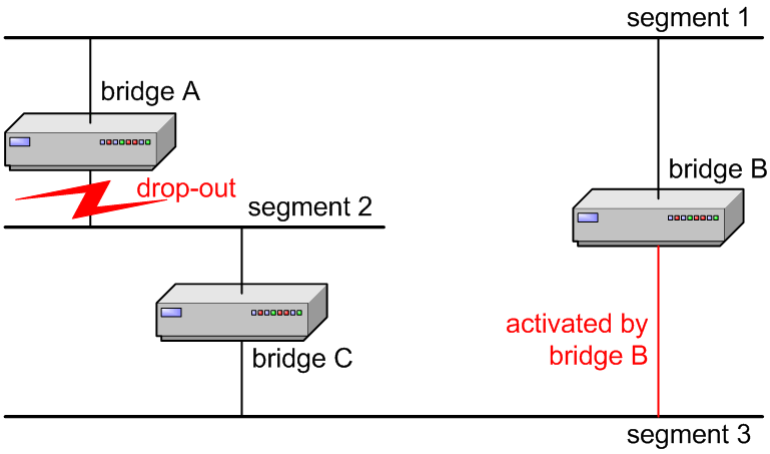


An alternate path has been established by connecting Bridge B in parallel with Bridges A and C. This also creates a potential bridge loop. However, by using the Spanning Tree Algorithm, Bridge B breaks the loop and blocks its path to segment 3.

Bridge failure

Bridges connected in a LAN must also detect bridge failure. They must then establish an alternative path. Should the root bridge fail, also a new root bridge must be selected.

A bridge failure is illustrated in the following figure:

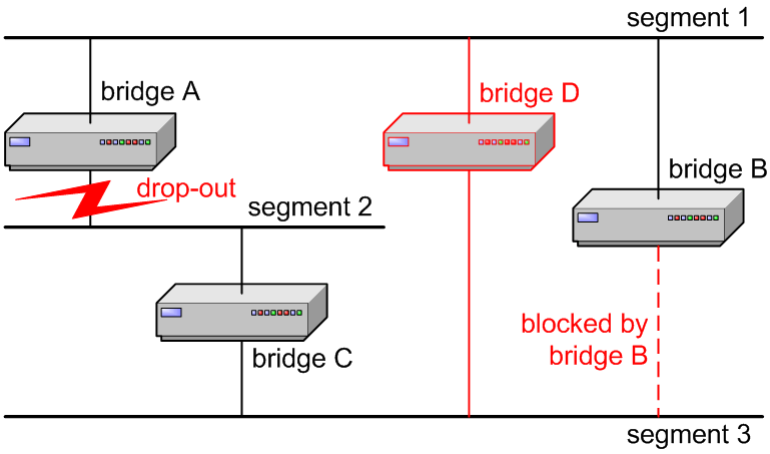


If Bridge A fails, the Spanning Tree Algorithm must be capable of activating an alternative path, such as Bridge B.

Network extension

Bridges connected in a LAN must also detect topology changes. They must adapt to these changes.

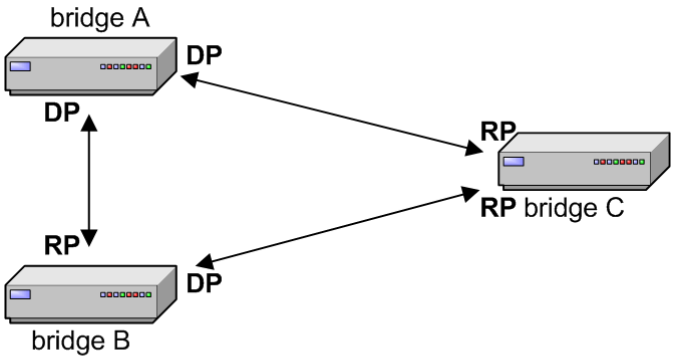
A topology change is illustrated in the following figure:



If the network is extended by adding Bridge D, the Spanning Tree Algorithm must be capable of adapting automatically to the new topology. This means that Bridge B stops looping by blocking the path to segment 3.

11.1.8 The Spanning Tree priority and cost

Consider the following Spanning Tree Topology:



RP = Root Port
DP = Designated Port

What is bridge priority?

In the example above, Bridge A is selected as the root bridge. This because the bridge priority of all the bridges is set to the default value (32768) and Bridge A has the lowest MAC address. However, due to traffic patterns or link types, Bridge A might not be the ideal root bridge.

By increasing the bridge priority (lowering the numerical priority value) of the ideal bridge so that it becomes the root bridge, you force a Spanning Tree recalculation to form a new spanning-tree topology with the ideal bridge as the root.

What is port priority and path cost?

When the spanning-tree topology is calculated based on default parameters, the path between source and destination stations in a bridged network might not be ideal. The goal is to make the fastest link the root port.

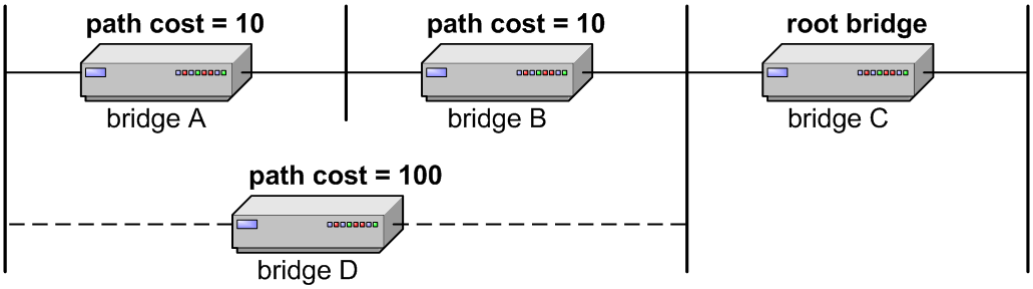
For example, assume on Bridge B that …

- port 1, currently the root port, is an unshielded twisted-pair link,
- port 2 is a fibre-optic link.

Network traffic might be more efficient over the high-speed fibre-optic link. By changing the spanning-tree port priority or path cost for port 2 to a higher priority (lower numerical value) than port 1, port 2 becomes the root port.

Example

By changing the priority and/or the pathCost, you can create a "preferred" path:



By setting the path costs of Bridge A and B to a lower value than the path cost of Bridge D, you can create a *preferred* path through Bridge A and B. The path through Bridge D becomes the *back-up* path.

11.2 Configuring bridging

This section lists the attributes you can use to configure bridging. The following gives an overview of this section:

- 11.2.1 - Introducing the bridging attributes on page 273
- 11.2.2 - Configuring the bridge group on page 274
- 11.2.3 - Adding a bridge group on page 275
- 11.2.4 - Enabling bridging on an interface on page 277
- 11.2.5 - Configuring bridging on an interface on page 278
- 11.2.6 - Explaining the bridging structure on page 279

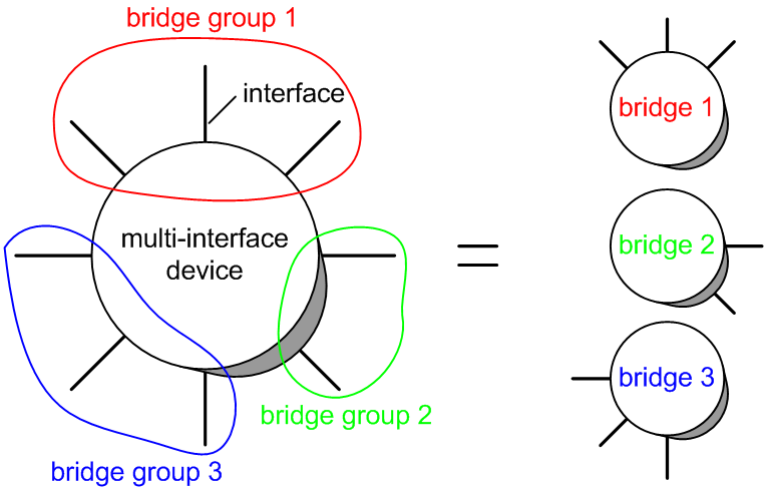
11.2.1 Introducing the bridging attributes

What is a bridge group?

A bridge group comprises the main bridging process. So in the containment tree, the bridgeGroup object contains the general bridging attributes.

What are multiple bridge groups?

The Telindus 1431 SHDSL CPE offers the possibility to create multiple bridge groups. This means you can group some interfaces in one bridge group while you group several other interfaces in another bridge group. By doing so, it is as if you created several “simple” bridge devices within one device.



Bridging on the different interfaces

In addition to configuring the general bridging process using the configuration attributes of the bridge group, you also have to configure bridging on each interface on which you want to use bridging.

11.2.2 Configuring the bridge group

Refer to …

- 11.1 - Introducing bridging on page 262 for an introduction on bridging.
- 11.2.1 - Introducing the bridging attributes on page 273 for an introduction on the bridging attributes.

This section lists the most important configuration attributes of the bridge group.

Configuring an IP address on the bridge group

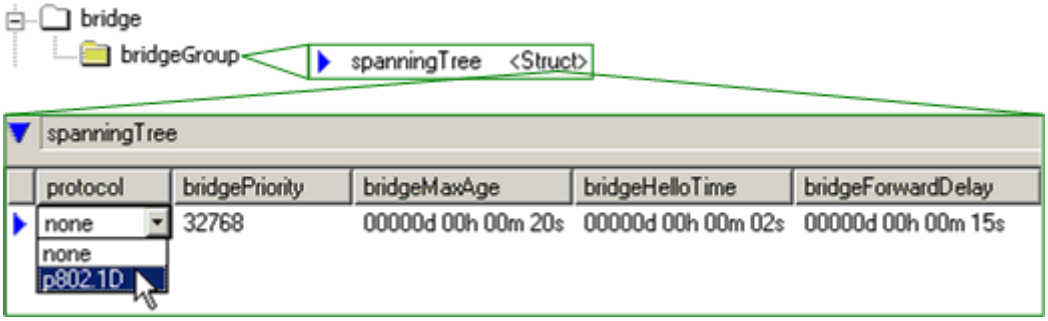
As on other interfaces (LAN, PVCs, etc.), you can configure an IP address on the bridge group. Do this using the configuration attribute telindus1431Router/bridge/bridgeGroup/ip on page 538.

What is more, if you enable bridging on the LAN interface (telindus1431Router/lanInterface/mode = bridging), then the settings of the configuration attribute telindus1431Router/lanInterface/ip are ignored. So in this case, if you want to manage the Telindus 1431 SHDSL CPE via IP, then you have to configure an IP address in the bridgeGroup object instead.

Selecting the bridging protocol

Refer to 11.1.2 - The self-learning and Transparent Spanning Tree bridge on page 264 for an introduction.

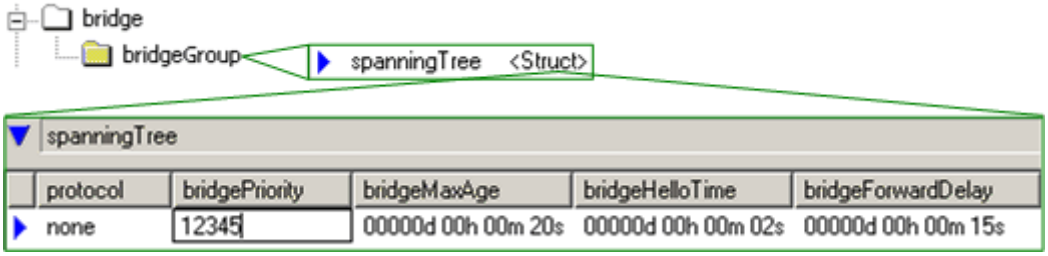
Use the protocol element in the spanningTree structure to select the bridging protocol. Refer to telindus1431Router/bridge/bridgeGroup/spanningTree on page 540.



Setting the bridge priority

Refer to 11.1.8 - The Spanning Tree priority and cost on page 270 for more information on bridge priority.

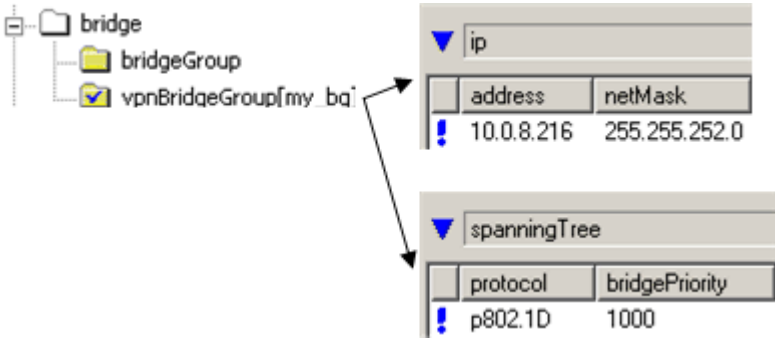
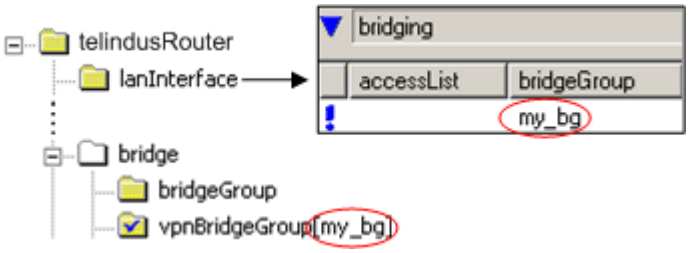
Use the bridgePriority element in the spanningTree structure to set the bridge priority. Refer to telindus1431Router/bridge/bridgeGroup/spanningTree on page 540.



11.2.3 Adding a bridge group

As said in 11.2.1 - Introducing the bridging attributes on page 273, you can add several bridge groups.

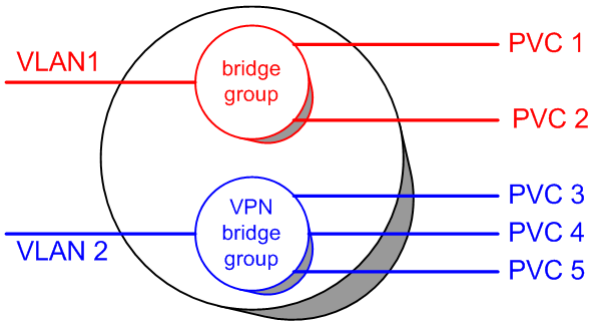
In order to add a bridge group, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the bridge object and add a vpnBridgeGroup[ ] object underneath (refer to 4.4 - Adding an object to the containment tree on page 49). E.g. vpnBridgeGroup[my_bg]
2	In the vpnBridgeGroup[ ] object you just added, configure the attributes to your needs. Example: Suppose you configure an IP address on the bridge group, activate the spanning tree protocol and set a bridge priority. 
3	Now you can add interfaces to the bridge group you just created. Do this by entering the name of the bridge group in the bridging/bridgeGroup element of the interfaces you want to add. Refer to 11.2.6 - Explaining the bridging structure on page 279 (more specifically to the bridgeGroup element) for more information. Example: Suppose you want to add the LAN interface to the vpnBridgeGroup[my_bg] object you previously added, then type the string “my_bg” in the bridgeGroup element of the bridging structure of the lanInterface object. 

Example - multiple bridge groups

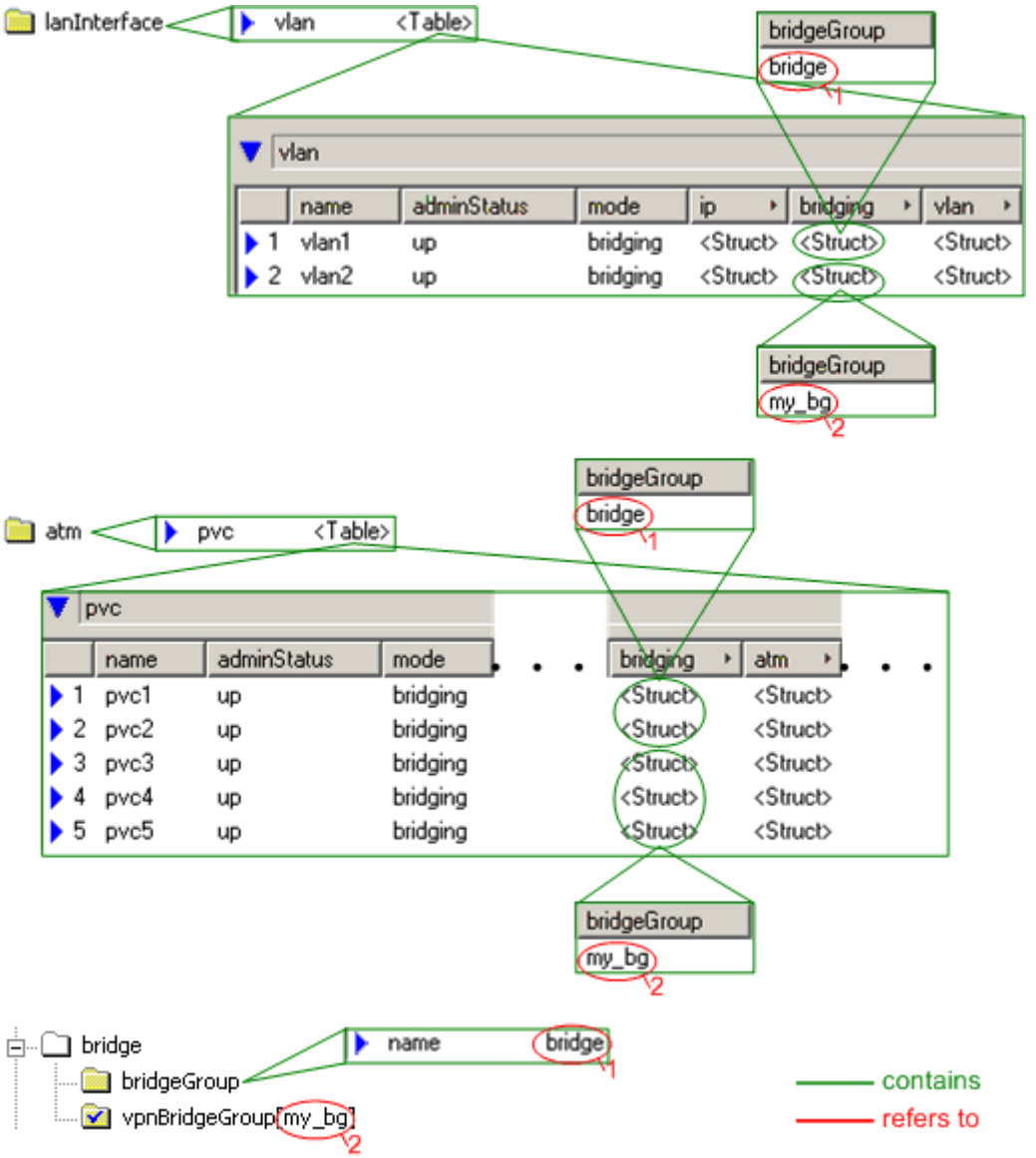
Suppose …

- you have 2 VLANs (VLAN 1 and VLAN 2).
- you have 5 PVCs (PVC 1 up to PVC 5).
- you want to assign VLAN 1 and PVC 1 and 2 to the default bridge group.
- you want to assign VLAN 2 and PVC 3, 4 and 5 to a bridge group you added yourself.



So first, add a bridge group to the containment tree (e.g. vpnBridgeGroup[my_bg]. Then assign the different interfaces to the different bridge groups by specifying bridge group names in the bridging/bridgeGroup elements of the different interfaces. Also set the different interfaces in bridging mode.

The configuration looks as follows:



11.2.4 Enabling bridging on an interface

Refer to …

- 11.1 - Introducing bridging on page 262 for an introduction on bridging.
- 11.2.1 - Introducing the bridging attributes on page 273 for an introduction on the bridging attributes.

Per IP interface you can determine whether you perform routing, bridging or both. The following table shows, for each IP interface, how to enable bridging on this interface:

Interface	How to enable bridging?
LAN interface	Set the mode attribute to bridging or routingAndBridging. The mode attribute can be found in the lanInterface object: telindus1431Router/lanInterface/mode. **Important remark** If you set the configuration attribute telindus1431Router/lanInterface/mode to bridging, then the settings of the configuration attribute telindus1431Router/lanInterface/ip are ignored. As a result, if you want to manage the Telindus 1431 SHDSL CPE via IP, you have to configure an IP address in the bridgeGroup object instead: telindus1431Router/bridge/bridgeGroup/ip.
VLAN on the LAN interface	Set the mode element to bridging or routingAndBridging. The mode element can be found in the vlan table which is located in the lanInterface object: telindus1431Router/lanInterface/vlan/mode.
ATM PVC	Set the mode element to bridging or routingAndBridging. The mode element can be found in the pvcTable table which is located in the atm object: telindus1431Router/wanInterface/atm/pvcTable/mode.
L2TP tunnel	Set the mode element to bridging or routingAndBridging. The mode element can be found in the l2tpTunnels table which is located in the tunnels object: telindus1431Router/router/tunnels/l2tpTunnels/mode.
IPSEC L2TP tunnel	Set the mode element to bridging or routingAndBridging. The mode element can be found in the ipsecL2tpTunnels table which is located in the tunnels object: telindus1431Router/router/tunnels/ipsecL2tpTunnels/mode.

11.2.5 Configuring bridging on an interface

Refer to …

- 11.1 - Introducing bridging on page 262 for an introduction on bridging.
- 11.2.1 - Introducing the bridging attributes on page 273 for an introduction on the bridging attributes.

Once the bridging process is enabled on the interface (refer to 11.2.4 - Enabling bridging on an interface on page 277) you can configure the bridging parameters of this interface. Use the elements in the bridging structure for this purpose. The following table shows you the location of the bridging structure for each interface:

Interface	Location of the bridging parameters
LAN interface	In the bridging structure of the lanInterface object: telindus1431Router/lanInterface/bridging. **Important remark** If you set the configuration attribute telindus1431Router/lanInterface/mode to bridging, then the settings of the configuration attribute telindus1431Router/lanInterface/ip are ignored. As a result, if you want to manage the Telindus 1431 SHDSL CPE via IP, you have to configure an IP address in the bridgeGroup object instead: telindus1431Router/bridge/bridgeGroup/ip.
VLAN on the LAN interface	In the bridging structure of the vlan table which is located in the lanInterface object: telindus1431Router/lanInterface/vlan/bridging.
ATM PVC	In the bridging structure of the pvcTable which is located in the atm object: telindus1431Router/wanInterface/atm/pvcTable/bridging.
L2TP tunnel	In the bridging structure of the l2tpTunnels table which is located in the tunnels object: telindus1431Router/router/tunnels/l2tpTunnels/bridging.
IPSEC L2TP tunnel	In the bridging structure of the ipsecL2tpTunnels table which is located in the tunnels object: telindus1431Router/router/tunnels/ipsecL2tpTunnels/bridging.

Refer to 11.2.6 - Explaining the bridging structure on page 279 for a detailed explanation of the bridging structure.

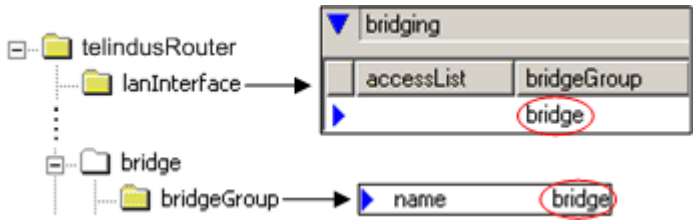
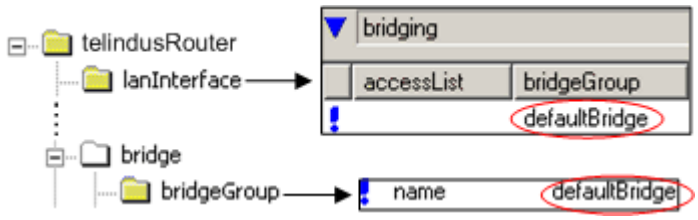
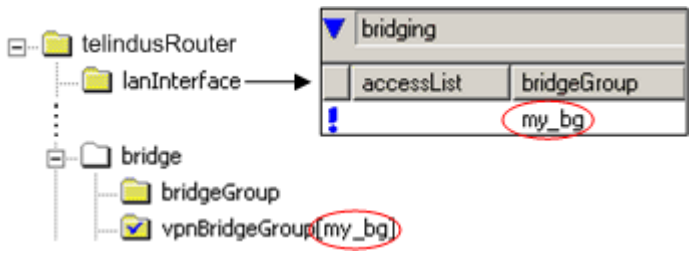
11.2.6 Explaining the bridging structure

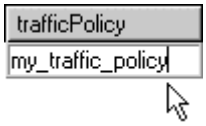
Because the bridging structure occurs in several objects, it is described here once and referenced where necessary. Refer to 11.2.5 - Configuring bridging on an interface on page 278 for the location of the bridging structure.

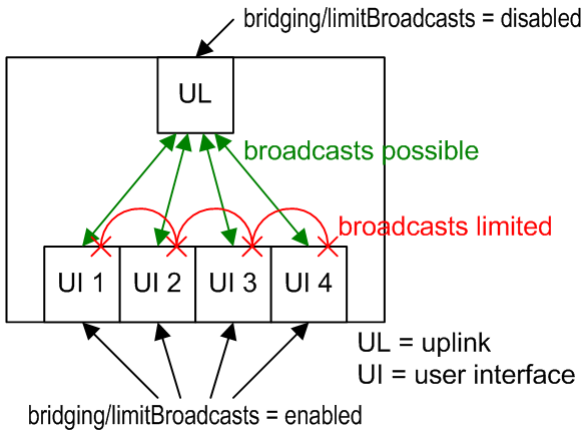
This section lists all the elements that can be present in the bridging structure. However, depending on the interface, it is possible that not all of these elements are present.

The bridging structure contains the following elements:

Element	Description
accessList	Use this element set up an outbound access list on the interface. Default:<empty> Range: 0 … 24 characters Do this by entering the index name of the access list you want to use. You can create the access list itself by adding an accessList object under the bridge object and by configuring the attributes in this object. **Example** If you created a accessList object with index name my_access_list (i.e. accessList[my_access_list]) and you want to apply this access list here, then enter the index name as value for the accessList element. Refer to … • 12.2.1 - The different access restrictions on the Telindus 1431 SHDSL CPE on page 295 for an introduction on access lists. • 14.10.2 - Bridge access list configuration attributes on page 549 for more information on bridge access lists.

Element	Description
bridgeGroup	Use this element to determine to which bridge group the interface belongs. Default:bridge Range: 1 ... 24 characters You have the possibility to create multiple bridge groups (refer to 11.2.3 - Adding a bridge group on page 275). Then, you can assign some interfaces to one bridge group while you assign several other interfaces to another bridge group. By default, the interface is assigned to the default bridge group (provided the configuration attribute telindus1431Router/bridge/bridgeGroup/name of the default bridge group still has its default value "bridge"). You can assign the interface to another bridge group than the default bridge group by specifying the index name of the bridge group in the bridgeGroup element. **Examples** • By default, both the bridgeGroup element and the configuration attribute telindus1431Router/bridge/bridgeGroup/name of the default bridge group are set to "bridge". This means that by default the interface is assigned to the default bridge group.  • Suppose you change the name of the default bridge group (by changing the value of the configuration attribute telindus1431Router/bridge/bridgeGroup/name). If you still want to assign the interface to the default bridge group, then you have to enter the new name of the default bridge group in the bridgeGroup element of the interface.  • Suppose you add a bridge group with index name my_bg and you want to assign the interface to this bridge group, then enter the index name as value for the bridgeGroup element. 

Element	Description
trafficPolicy	This element is not present in the telindus1431Router/lanInterface/bridging structure. Use this element to apply a traffic policy on the bridged data on the interface. Default:<empty> Range: 0 ... 24 characters Do this by entering the index name of the traffic policy you want to use. You can create the traffic policy itself by adding a trafficPolicy object under the bridge object and by configuring the attributes in this object. **Example** If you created a trafficPolicy object with index name my_traffic_policy (i.e. trafficPolicy[my_traffic_policy]) and you want to apply this traffic policy here, then enter the index name as value for the trafficPolicy element.  Refer to 11.3 - Configuring traffic and priority policy on the bridge on page 283 for more information on policies.
priority	Use this element to set the port priority of the interface. Default:128 Range: 0 ... 255 Each port of a bridge has a *unique port identifier*. The priority element is a part of this port identifier and allows you to change the priority of the port. It is taken as the more significant part in priority comparisons. The other part of the unique port identifier has a fixed relationship to the physical or logical port. This assures the uniqueness of the unique port identifier among the ports of a single bridge. Refer to 11.1.8 - The Spanning Tree priority and cost on page 270 for more information on port priority.
pathCost	Use this element to set the path cost of the interface. Default:100 Range: 1 ... 65535 The path cost is the value that is added to the total cost of the path to the root bridge, provided that this particular port is a root port. I.e. that the path to the root goes through this port. The total cost of the path to the root bridge should not exceed 65500. Refer to 11.1.8 - The Spanning Tree priority and cost on page 270 for more information on port priority.
topologyChange-Detection	Use this element to enable or disable the communication of Spanning Tree topology changes to the root bridge. Default:enabled Range: enabled / disabled

Element	Description
limitBroadcasts	Use this element to limit broadcasts between interfaces for which the limitBroadcasts element is set to enabled. Default:disabled Range: enabled / disabled **Example** Suppose you have the following set-up: • Four links towards four different users (clients). • One uplink towards the backbone. • All links are configured for bridging.  In this case you probably want that broadcasts coming from the uplink are distributed to the user links and that broadcasts coming from the user links are forwarded to the uplink. However, you most likely do not want that broadcasts coming from one user link are distributed over all the other user links. Therefore, set the limitBroadcasts element to enabled on all interfaces that may not forward each other's broadcasts.

11.3 Configuring traffic and priority policy on the bridge

Refer to …

- 10.8.1 - Introducing traffic and priority policy on page 239 for an introduction on traffic and priority policy.
- 10.8.2 - Traffic and priority policy on routed and on bridged data on page 243 for the difference between traffic and priority policy on the bridge and the router.

This section gives a short description of the attributes you can use to configure traffic and priority policy on the bridge.

The following gives an overview of this section:

- 11.3.1 - How to configure a traffic and priority policy on the bridge? on page 284
- 11.3.2 - Configuring a traffic policy on the bridge on page 285
- 11.3.3 - Applying a traffic policy on a certain interface of the bridge on page 286

11.3.1 How to configure a traffic and priority policy on the bridge?

Refer to 10.8.1 - Introducing traffic and priority policy on page 239 for an introduction.

To configure a traffic and priority policy for the bridged data on a certain interface, proceed as follows:

Step	Action
1	Create and configure a bridging traffic policy. Refer to 11.3.2 - Configuring a traffic policy on the bridge on page 285.
2	Apply the bridging traffic policy on the desired interface. Refer to 11.3.3 - Applying a traffic policy on a certain interface of the bridge on page 286.
3	Create and configure a priority policy. Refer to 10.8.6 - Creating a priority policy on page 248.
4	Apply the priority policy on the desired interface. Refer to 10.8.7 - Applying a priority policy on an interface on page 250.

11.3.2 Configuring a traffic policy on the bridge

Refer to 11.3.1 - How to configure a traffic and priority policy on the bridge? on page 284 for an overview on how to configure a traffic and priority policy. To give you an idea of where you are in the process, the following also gives a quick overview:

- → **Create and configure a bridging traffic policy. ← You are here.**
- Apply the bridging traffic policy on the desired interface.
- Create and configure a priority policy.
- Apply the priority policy on the desired interface.

To create and configure a traffic policy for the bridged data on a certain interface, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the bridge object and add a trafficPolicy[ ] object underneath (refer to 4.4 - Adding an object to the containment tree on page 49).
2	In the traffic policy object you just added, go to the vlanPriorityMap attribute. Use this attribute to impose a traffic policy on the bridged VLAN frames received by the Telindus 1431 SHDSL CPE. Refer to telindus1431Router/bridge/trafficPolicy[ ]/vlanPriorityMap on page 552 for more information.
3	In the traffic policy object you just added, go to the dropLevels attribute. Use this attribute to define for each user configurable queue, how many packets may be queued before they are dropped. Refer to telindus1431Router/bridge/trafficPolicy[ ]/dropLevels on page 552 for more information.

11.3.3 Applying a traffic policy on a certain interface of the bridge

Refer to 11.3.1 - How to configure a traffic and priority policy on the bridge? on page 284 for an overview on how to configure a traffic and priority policy. To give you an idea of where you are in the process, the following also gives a quick overview:

- Create and configure a bridging traffic policy.
- → **Apply the bridging traffic policy on the desired interface.** ← **You are here.**
- Create and configure a priority policy.
- Apply the priority policy on the desired interface.

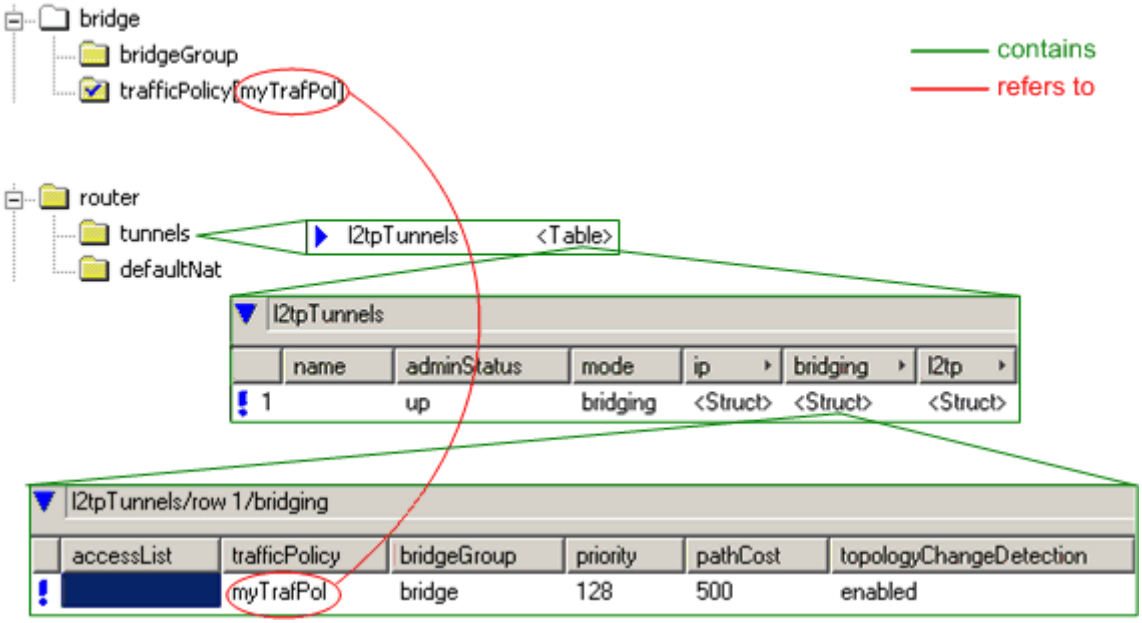
To apply a traffic policy for the bridged data on a certain interface, enter the index name of the earlier created traffic policy object as value of the trafficPolicy element. The trafficPolicy element can be found in the bridging structure of the IP interface. Refer to 11.2.5 - Configuring bridging on an interface on page 278 for the location of the bridging structure on the different IP interfaces.

On the LAN interface, you can not apply a bridging traffic policy.

Example - applying a traffic policy on an interface of the bridge

Suppose you created and configured a traffic policy object with index name myTrafPol (i.e. trafficPolicy[myTrafPol]), and you want to apply this traffic policy on an L2TP tunnel you created earlier.

The following figure shows how to configure this:



12 Configuring the additional features

This chapter introduces the most important additional features of the Telindus 1431 SHDSL CPE besides routing, bridging and switching and lists the attributes you can use to configure these features.

The following gives an overview of this chapter:

- 12.1 - Configuring DHCP on page 288
- 12.2 - Configuring the access restrictions on page 294
- 12.3 - Configuring VLANs on page 306
- 12.4 - Configuring L2TP tunnels on page 316
- 12.5 - Configuring IP security on page 326
- 12.6 - Configuring RADIUS on page 332
- 12.7 - Configuring QoS on page 342

Refer to the Reference manual on page 377 for a complete overview of the attributes of the Telindus 1431 SHDSL CPE.

12.1 Configuring DHCP

This section introduces the Dynamic Host Configuration Protocol (DHCP) and gives a short description of the attributes you can use to configure DHCP.

The following gives an overview of this section:

- 12.1.1 - Introducing DHCP on page 289
- 12.1.2 - Assigning static IP addresses on page 290
- 12.1.3 - Assigning dynamic IP addresses on page 291
- 12.1.4 - Configuring the Telindus 1431 SHDSL CPE as DHCP relay agent on page 293

12.1.1 Introducing DHCP

What is DHCP?

The DHCP protocol is a protocol for assigning IP addresses to devices on a network. DHCP can assign dynamic or static IP addresses. With dynamic addressing, a device can have a different IP address every time it connects to the network. What is more, the IP address can even change while the device is still connected.

Dynamic addressing simplifies network administration because the software keeps track of IP addresses rather than requiring an administrator to manage the task. This means that a new computer can be added to a network without the hassle of manually assigning it a unique IP address.

What is a DHCP relay agent?

Being a broadcast message, a DHCP request can not pass a router by default. To help a DHCP request pass the router, IP helper addresses have to be configured. This adds additional information to the request packets allowing servers on distant networks to send back the answer.

Combining static and dynamic DHCP tables

If you combine static and dynamic DHCP server tables, then on an incoming DHCP request first the static table is scanned for matches and then the dynamic DHCP table is considered.

How does the DHCP server react on a BootP request?

The DHCP server reacts on a BootP request as follows: the source MAC address of the incoming BootP request packet is compared with the MAC addresses that have been entered in the dhcpStatic table. Then, there are two possibilities:

- If the source MAC address corresponds with a MAC address in the dhcpStatic table, then the DHCP server replies with a BootP reply packet. In this reply, the IP address that is linked with the MAC address in question (as defined in the dhcpStatic table) is returned.
- If the source MAC address does not correspond with a MAC address in the dhcpStatic table, then the DHCP server returns no response on that frame.

Releasing IP addresses - DHCP versus BootP

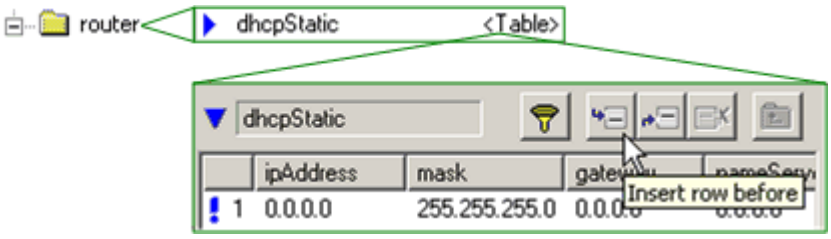
On DHCP level, it is regularly checked whether the device that has an IP address in lease is still connected to the network. If it is not, the IP address is returned to the pool of free IP addresses.

On BootP level, however, such a check (or *refresh*) does not exist. What is more, a statistic IP address lease is for an infinite time. Consequently, if the device that requested the IP address is no longer connected to the network, this is not detected by the server. In that case, the statistical information will still indicate that the IP address is leased although it is not.

12.1.2 Assigning static IP addresses

Refer to 12.1.1 - Introducing DHCP on page 289 for an introduction.

To assign static IP addresses to an IP device, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object, select the dhcpStatic attribute and add one or more entries to this table.  Use this attribute to assign a fixed IP address to an IP device and this for an infinite time. Add a row to the dhcpStatic table for each IP address you want to assign.
2	Configure the elements of the dhcpStatic table. The most important are: • ipAddress. Use this element to assign an IP address to a certain client. This client is identified with its MAC address. • mask. Use this element to set the client its subnet mask. • gateway. Use this element to set the default gateway for the client its subnet. If the interface element is left empty (default), then it is the gateway element that determines on which interface the Telindus 1431 SHDSL CPE will act as DHCP server. Namely the interface through which the IP address as entered in the gateway element can be reached. • interface. Use this element to specify the name of the interface on which you want the Telindus 1431 SHDSL CPE to act as DHCP server. • macAddress. Use this element to enter the client its MAC address. Refer to telindus1431Router/router/dhcpStatic on page 479 for more information.

Important remark

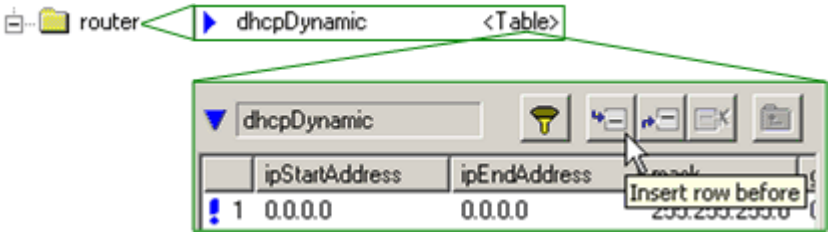
If you apply an access list on an interface[1] of the Telindus 1431 SHDSL CPE through which DHCP requests have to be received, then make sure that this access list *explicitly allows* the passing of DHCP packets! This to make sure that the DHCP packets are not dropped should you accidently misconfigure the access list.

1. The term “interface” also implies the Telindus 1431 SHDSL CPE its own protocol stack. So if an access list is applied on the protocol stack, then also in this case make sure that the DHCP packets are allowed to pass.

12.1.3 Assigning dynamic IP addresses

Refer to 12.1.1 - Introducing DHCP on page 289 for an introduction.

To assign dynamic IP addresses to an IP device, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object, select the dhcpDynamic attribute and add one or more entries to this table.  Use this attribute to assign an IP address selected from an IP address range to an IP device and this for a certain time. Add a row to the dhcpDynamic table for each IP address range you want to create.
2	Configure the elements of the dhcpDynamic table. The most important are: • ipStartAddress. Use this element to define the start address of the IP address range. It is from this range that an IP address will be dynamically assigned to a client. • ipEndAddress. Use this element to define the end address of the IP address range. It is from this range that an IP address will be dynamically assigned to a client. • mask. Use this element to set the client its subnet mask for the specified IP address range. • gateway. Use this element to set the default gateway for the client its subnet. If the interface element is left empty (default), then it is the gateway element that determines on which interface the Telindus 1431 SHDSL CPE will act as DHCP server. Namely the interface through which the IP address as entered in the gateway element can be reached. • interface. Use this element to specify the name of the interface on which you want the Telindus 1431 SHDSL CPE to act as DHCP server. • leaseTime. Use this element to set the maximum time a client can lease an IP address from the specified IP address range. If 00000d 00h 00m 00s (default) is specified, then the lease time is infinite. Refer to telindus1431Router/router/dhcpDynamic on page 481 for more information.

Important remark

If you apply an access list on an interface[1] of the Telindus 1431 SHDSL CPE through which DHCP requests have to be received, then make sure that this access list *explicitly allows* the passing of DHCP packets! This to make sure that the DHCP packets are not dropped should you accidently misconfigure the access list.

1. The term “interface” also implies the Telindus 1431 SHDSL CPE its own protocol stack. So if an access list is applied on the protocol stack, then also in this case make sure that the DHCP packets are allowed to pass.

12.1.4 Configuring the Telindus 1431 SHDSL CPE as DHCP relay agent

Refer to 12.1.1 - Introducing DHCP on page 289 for an introduction.

To configure the Telindus 1431 SHDSL CPE as DHCP relay agent, proceed as follows:

Step	Action
1	Specify (a) helper IP address(es) using the helpers element in the ip structure. Refer to 5.2.3 - Explaining the ip structure on page 60 for more information.
2	Now specify the helper protocols. By default, the helperProtocols table is empty. In this case the BootP/DHCP requests (among others) are forwarded automatically. However, specifying at least one value in the helperProtocols table clears the default helper list automatically. In that case you explicitly have to enter the BootP/DHCP protocol in the helperProtocols table. Refer to telindus1431Router/router/helperProtocols on page 476 for more information.

12.2 Configuring the access restrictions

This section explains how to control the access to the Telindus 1431 SHDSL CPE for both management data and user data. First this section gives an overview of the different access restrictions that you can apply on the Telindus 1431 SHDSL CPE. Then it highlights the most complex access restriction: the extended access lists. It introduces extended access lists and shows you how to set them up.

The following gives an overview of this section:

- 12.2.1 - The different access restrictions on the Telindus 1431 SHDSL CPE on page 295
- 12.2.2 - Introducing extended access lists on page 298
- 12.2.3 - Setting up an extended access list on page 299
- 12.2.4 - Tuning an extended access list on page 301
- 12.2.5 - Remarks on extended access lists on page 305

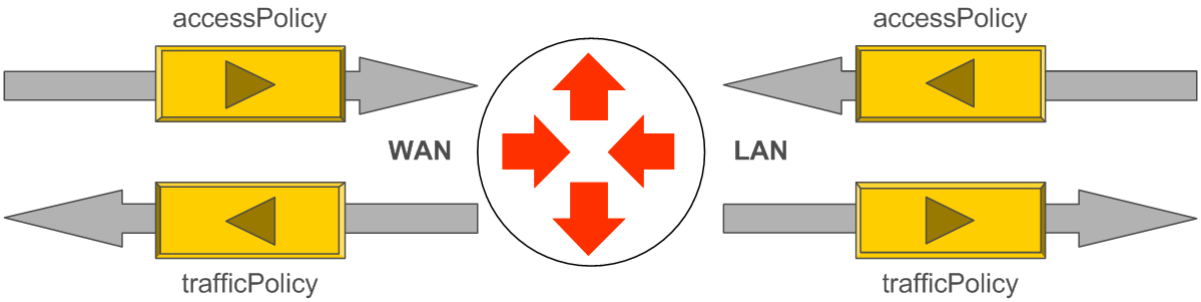
12.2.1 The different access restrictions on the Telindus 1431 SHDSL CPE

This section gives an overview of the different access restrictions that you can apply on the Telindus 1431 SHDSL CPE.

IP interface

You can apply the following access restrictions on an IP interface

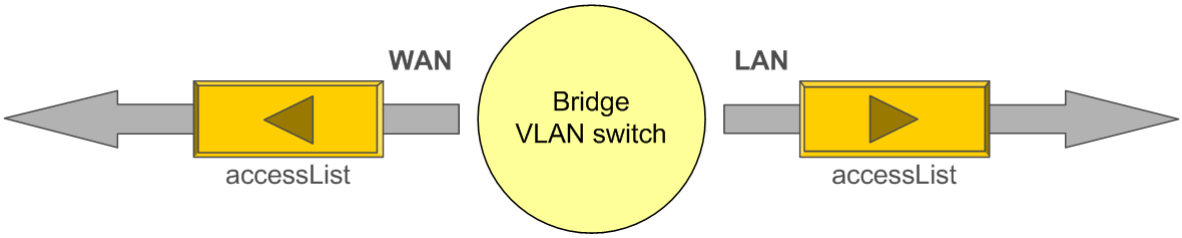
Access restrictions on user data	Quick configuration
Inbound extended access list with “allow” and/or “deny” rules.	1. Add and configure a router/trafficPolicy[ ] object. E.g. trafficPolicy[myInList]. 2. Apply the traffic policy by typing the index name of the trafficPolicy[ ] object as value of the accessPolicy element in the ip structure (e.g. “myInList”). Refer to 12.2.3 - Setting up an extended access list on page 299 for detailed information.
Outbound extended access list with “allow” rules.	1. Add and configure a router/trafficPolicy[ ] object. E.g. trafficPolicy[myOutList]. 2. Apply the traffic policy by typing the index name of the trafficPolicy[ ] object as value of the trafficPolicy element in the ip structure (e.g. “myOutList”). Refer to 12.2.3 - Setting up an extended access list on page 299 for detailed information.

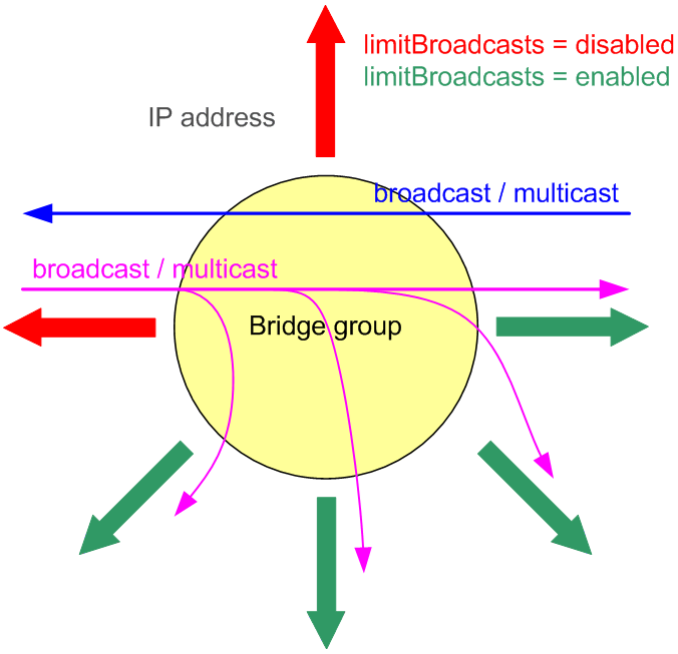


Bridge interface

You can apply the following access restrictions on a bridge interface:

Access restrictions on user data	Quick configuration
Outbound simple access list with “deny” rules.	1. Add and configure a bridge/accessList[ ] object. E.g. accessList[myList]. 2. Apply the access list by typing the index name of the bridge/accessList[ ] object as value of the accessList element in the bridging structure (e.g. “myList”). Refer to telindus1431Router/bridge/accessList[ ]/macAddress on page 550 for detailed information.
Prevent broadcasts and multicasts from flooding to all interfaces	Configure the limitBroadcasts element in the bridging structure. Refer to limitBroadcasts on page 282 for detailed information.

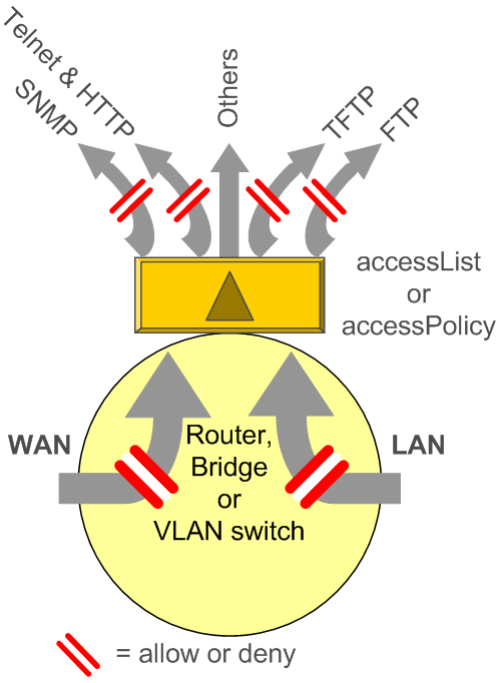




Protocol stack

You can apply the following access restrictions on the protocol stack

Access restrictions on management data	Quick configuration
Inbound simple access list with “allow” and/or “deny” rules.	Configure the accessList attribute in the management object. Refer to telindus1431Router/management/accessList on page 560 for detailed information.
Inbound extended access list with “allow” and/or “deny” rules.	1. Add and configure a router/trafficPolicy[ ] object. E.g. trafficPolicy[myMgtList]. 2. Apply the traffic policy by typing the index name of the trafficPolicy[ ] object as value of the accessPolicy attribute in the management object (e.g. “myMgtList”). Refer to 12.2.3 - Setting up an extended access list on page 299 for detailed information.
Easy protocol restrictions without the need of an access list (Telnet, FTP, TFTP, SNMP: allow / deny).	Configure the telnet, ftp, tftp and snmp attributes in the management object. Refer to 14.12 - Management configuration attributes on page 555 for detailed information.
Access restrictions per IP interface (allow / deny)	Configure the mgmtAccess element in the ip structure. Refer to mgmtAccess on page 63 for detailed information.
Access restrictions per bridge interface (on VLAN level: allow / deny)	Configure the localAccess attribute in the bridgeGroup object. Refer to telindus1431Router/bridge/bridgeGroup/localAccess on page 541 for detailed information.



12.2.2 Introducing extended access lists

What is an extended access list?

Access lists control the access to or from an interface for a number of specified services or IP addresses. The access list describes the condition to forward (permit) packets to an interface or to drop (deny) them.

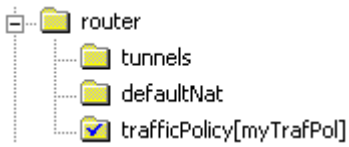
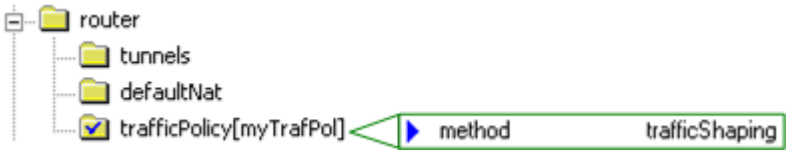
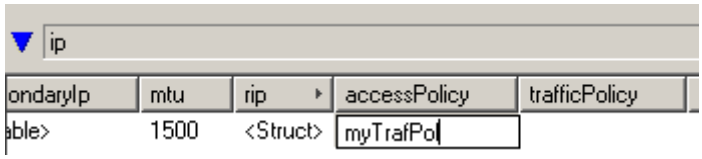
When access lists are combined with NAT/PAT translation, then first the conditions of the access list are applied before the NAT/PAT translation is done.

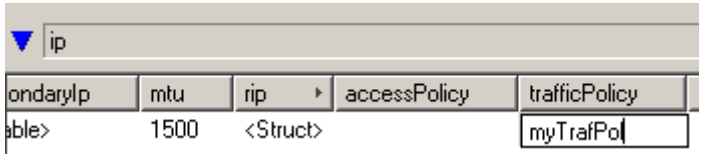
On the Telindus 1431 SHDSL CPE, the extended access lists are implemented using the traffic policy function and by defining traffic shaping rules.

12.2.3 Setting up an extended access list

This section explains how to set up an extended access list. 12.2.4 - Tuning an extended access list on page 301, explains how to configure the access list. I.e. how to define the filter criteria.

In order to set up an extended access list, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and add a trafficPolicy[ ] object underneath (refer to 4.4 - Adding an object to the containment tree on page 49). 
2	In the traffic policy object you just created, make sure that the configuration attribute method is set to trafficShaping (this is the default value). 
3	Configure the configuration attribute telindus1431Router/router/trafficPolicy[ ]/trafficShaping to match you filter criteria. Refer to 12.2.4 - Tuning an extended access list on page 301.
4	Apply the traffic policy on the desired interface. See below. **Setting up an inbound extended access list on an IP interface** 1. Go to the ip attribute of the interface on which you want to apply your extended access list. For example, suppose you want to apply an extended access list on the LAN interface, then go to lanInterface object and then go to the ip attribute. 2. In the ip attribute, enter the index name of the traffic policy object you created in step 1 as value of the accessPolicy element. In our example, enter the string myTrafPol as value of the accessPolicy element. 

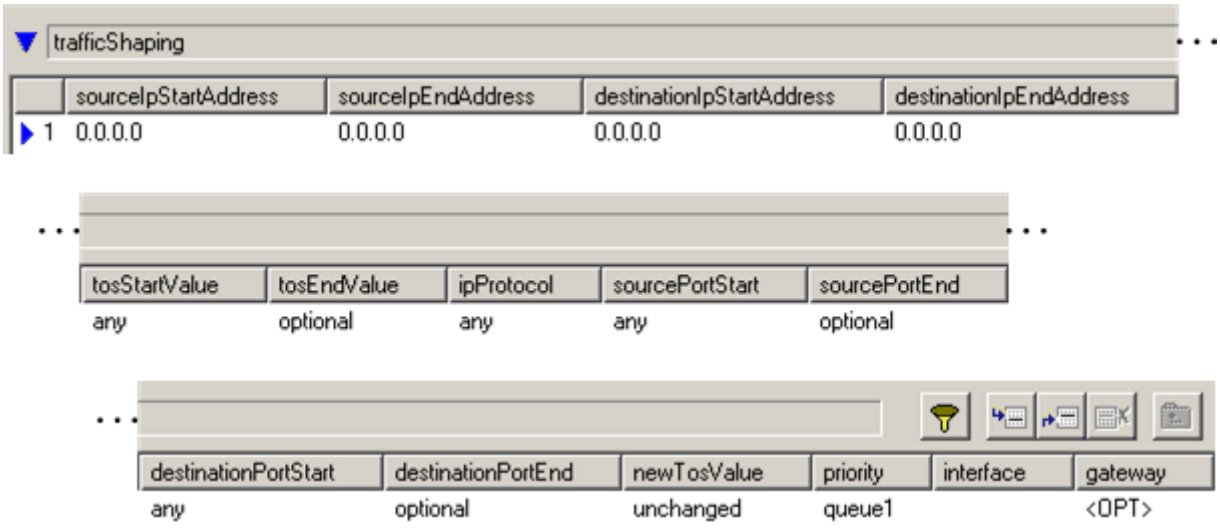
Step	Action
5	**Setting up an outbound extended access list on an IP interface** 1. Go to the ip attribute of the interface on which you want to apply your extended access list. For example, suppose you want to apply an extended access list on the LAN interface, then go to lanInterface object and then go to the ip attribute. 2. In the ip attribute, enter the index name of the traffic policy object you created in step 1 as value of the trafficPolicy element. In our example, enter the string myTrafPol as value of the trafficPolicy element. 
6	**Setting up an inbound extended access list on the protocol stack** Go to the management object and enter the index name of the traffic policy object you created in step 1 as value of the accessPolicy attribute. **Important remark** It is possible that the Telindus 1431 SHDSL CPE has to answer to DHCP requests or terminate L2TP and IPSec tunnels. In that case, if you set up an access list on the protocol stack, then make sure that these protocols are allowed access to the protocol stack.

12.2.4 Tuning an extended access list

Whereas 12.2.3 - Setting up an extended access list on page 299 shows you how to set up an extended access list, this section shows you how to tune the access list. I.e. how to define the filter criteria.

You have to define your filter criteria in the telindus1431Router/router/trafficPolicy[ ]/trafficShaping attribute. This is a table, which is empty by default, but to which you can add several lines (entries).

The following shows a screenshot of the trafficShaping table containing one line:



As you can see from the elements in the trafficShaping table, you can filter on several criteria:

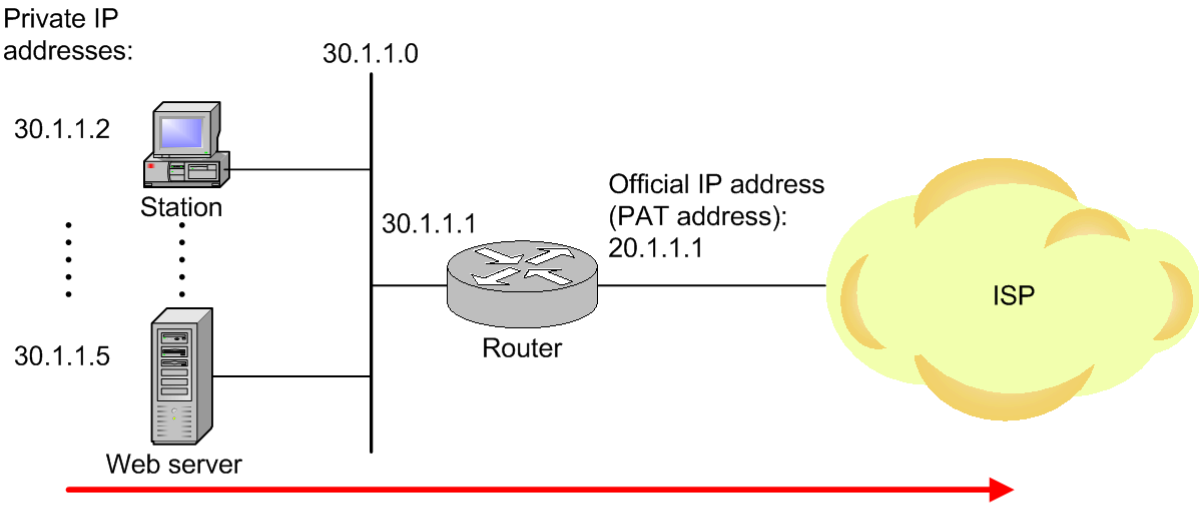
Filter criterion	Description
IP addresses	• 1 IP address: enter an IP address in the element sourceIpStartAddress and/or destinationIpStartAddress. • IP address range: enter an IP address range using the elements … - sourceIpStartAddress and sourceIpEndAddress and/or - destinationIpStartAddress and destinationIpEndAddress So if you define 1 or more IP addresses in the trafficShaping table, then traffic from (source) or to (destination) these IP addresses is allowed. All other traffic is discarded.
IP protocol	Specify an IP protocol using the ipProtocol element. Either select one of the common IP protocols from the ipProtocol element its drop-down box, or directly type a specific protocol number in the ipProtocol element field. So if you define an IP protocol in the trafficShaping table, then traffic carrying this IP protocol is allowed. All other traffic is discarded.

Filter criterion	Description
port number	• 1 port number: enter a port number in the element sourcePortStart and/or destinationPortStart. • port number range: enter a port number range using the elements … - sourcePortStart and sourcePortEnd - and/or - destinationPortStart and destinationPortEnd So if you define 1 or more port numbers in the trafficShaping table, then traffic carrying these port numbers is allowed. All other traffic is discarded. You can not filter on port numbers only. What is more, you can only filter on port numbers when the IP protocol is set to TCP or UDP. So in other words, if the IP protocol element is set to a value different from TCP or UDP, then all the port elements are ignored.
Type Of Service (TOS) value	• 1 TOS value: enter a TOS value in the element tosStartValue. • TOS value range: enter a TOS value range using the elements tosStartValue and tosEndValue. So if you define 1 or more TOS values in the trafficShaping table, then traffic carrying these TOS values is allowed. All other traffic is discarded.

Example - configuring an extended access list

This is an example of a network connected to the Internet and for which the following conditions are required:

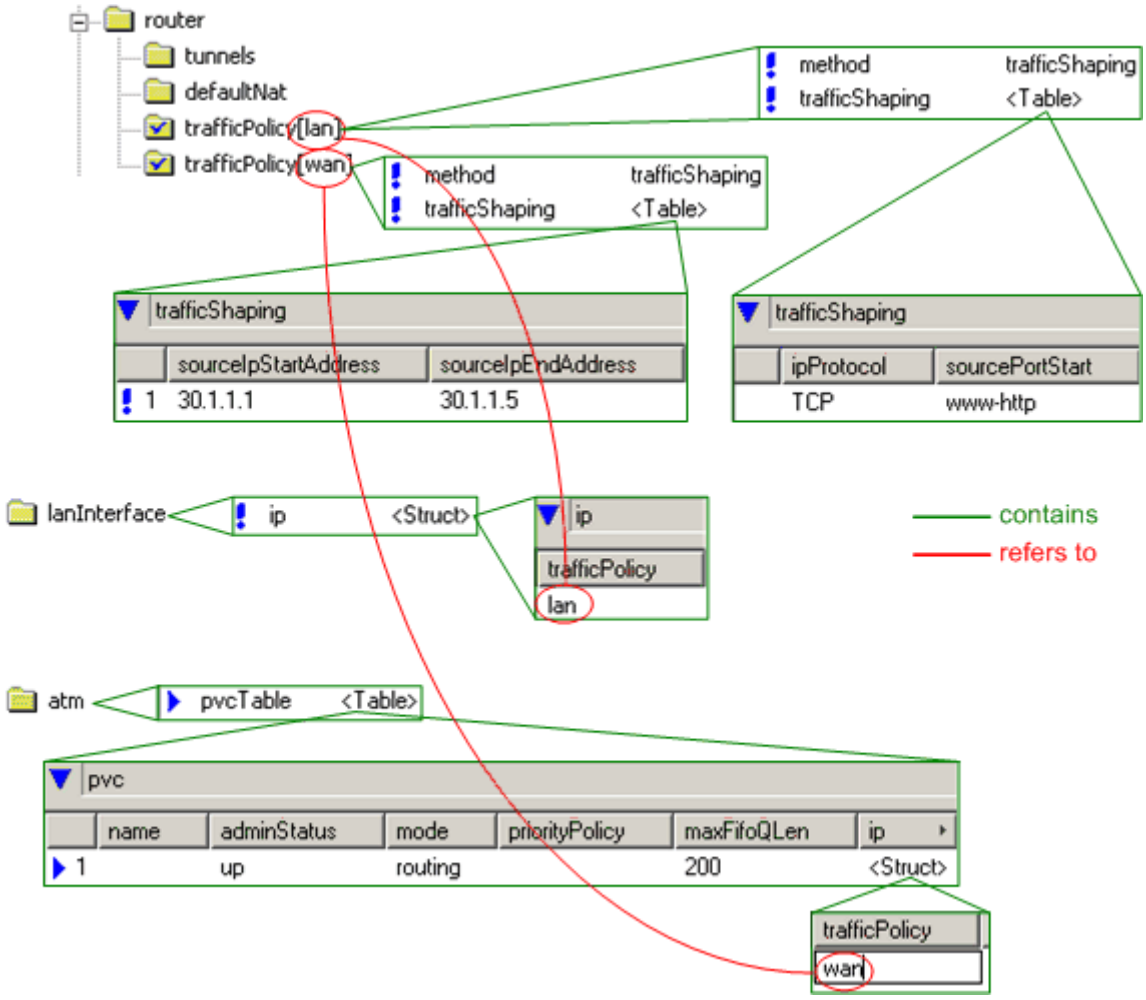
- only 5 stations may have access to the Internet.
- only the HTTP-port for web browsing is open for incoming packets from the Internet.



The access list on the WAN interface (refer to the trafficPolicy[wan] object) filters outgoing traffic. Only the stations with IP addresses 30.1.1.1 up to 30.1.1.5 are allowed to access the Internet.	PAT : the source IP address 30.1.1.x is changed to 20.1.1.1 and the source port is changed to a free port.	To the WAN interface.

To the LAN interface.	The access list on the LAN interface (refer to the trafficPolicy[lan] object) filters incoming traffic. Only port number 80 (www-http) is allowed.

The following figure shows how to configure the extended access lists:



12.2.5 Remarks on extended access lists

- By default, the entries in the trafficShaping table are “allow” rules. I.e. only the traffic defined in the table is permitted, all other traffic is discarded (independent whether the traffic shaping table is used as an access list, for priority policing or policy based routing). However, you can inverse an entry making it a “deny” rule by entering “discard” as value of the interface element.

- If more than one entry applies to the same packet, then the entry which has the narrowest filter range (when looking at the filter criteria from left to right) is chosen. For example: two rows in the trafficShaping table apply to the same packet, but row 1 wants to forward packets to queue 3 and row 2 wants to forward packets to the low delay queue. In that case, first the IP source address is considered. The row with the smallest range wins. If the ranges are exactly the same, then the IP destination address is considered. And so on. Should the two rows be completely identical except for the queue, then one of the rows is chosen at random.

- You do not necessarily have to fill in IP addresses in the trafficShaping table. It is perfectly valid to filter on IP protocol, IP protocol/port combination or TOS values only. However, you can not filter on port numbers only. What is more, you can only filter on port numbers when the IP protocol is set to TCP or UDP. So in other words, if the IP protocol element is set to a value different from TCP or UDP, then all the port elements are ignored.

12.3 Configuring VLANs

This section introduces VLANs and gives a short description of the attributes you can use to configure VLANs.

The following gives an overview of this section:

- 12.3.1 - Introducing VLANs on page 307
- 12.3.2 - Setting up a VLAN on a LAN interface on page 308
- 12.3.3 - Setting up a VLAN on the bridge group on page 310
- 12.3.4 - Configuring VLAN switching on page 313

12.3.1 Introducing VLANs

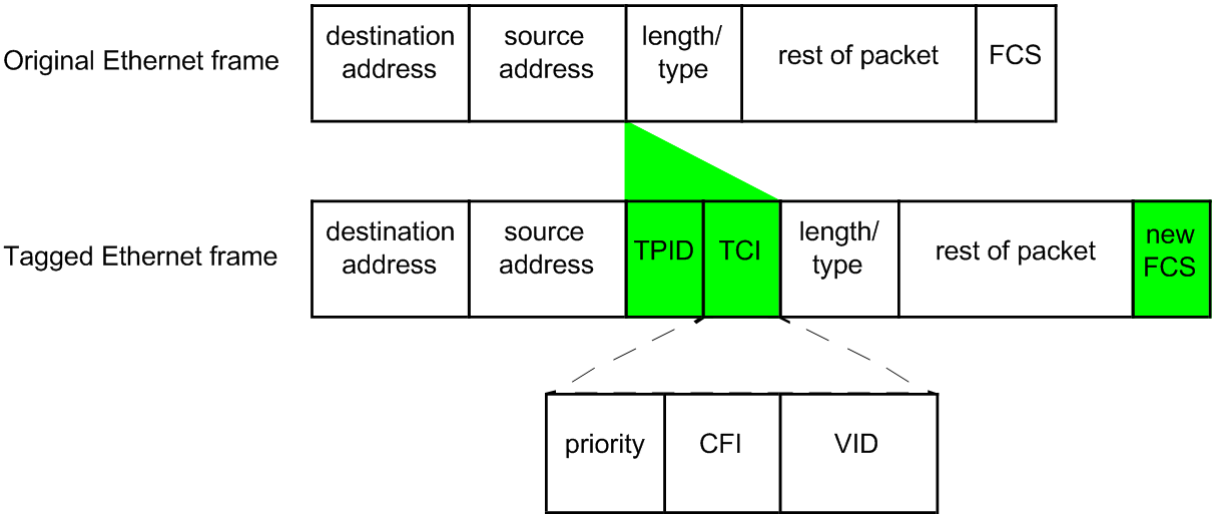
What is a VLAN?

A Virtual LAN (VLAN) is a group of devices on one or more LANs that are configured (using management software) so that they can communicate as if they were attached to the same wire, when in fact they are located on a number of different LAN segments. Because VLANs are based on logical instead of physical connections, they are extremely flexible.

What is a VLAN tag?

The VLAN tag header is inserted immediately following the destination MAC address and source MAC address fields of the frame. The VLAN tag header can be divided into two components:

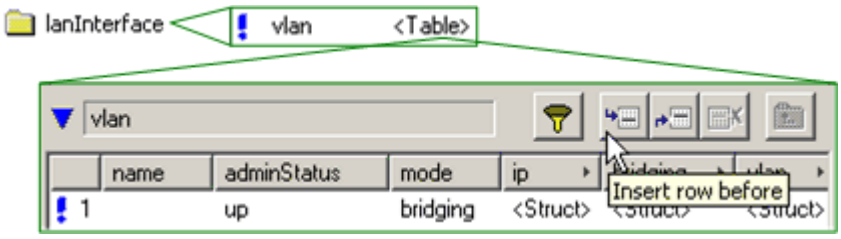
- TPID (Tag Protocol Identifier). The 802.1Q Ethernet-encoded TPID is defined as two octets with the value “8100”.
- TCI (Tag Control Information). The TCI field is also two octets in length and contains:
  - User priority. The user priority bits represents eight priority levels, 0 through 7. IEEE 802.1P defines the operation for these 3 user priority bits.
  - CFI (Canonical Format Indicator). The CFI bit indicates that all MAC address information carried by the frame that may be present in the MAC data is in Canonical format.
  - VID (VLAN Identifier). The twelve-bit VID field identifies the VLAN to which the frame belongs. Three VID values are reserved by the 802.1Q standard.



12.3.2 Setting up a VLAN on a LAN interface

Refer to 12.3.1 - Introducing VLANs on page 307 for an introduction.

To set up a VLAN on the LAN interface, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the lanInterface object, select the vlan attribute and add one or more entries to this table.  Use this attribute to configure the VLANs you want to set up. Add a row to the vlan table for each VLAN you want to set up. As long as no VLANs are created in the vlan table, the LAN interface accepts both VLAN untagged and VLAN tagged frames. The VLAN *untagged* frames are bridged and/or routed (depending on the setting of the mode attribute). The VLAN *tagged* frames are bridged (in case the mode attribute is set to bridging or bridgingAndRouting, else they are discarded). As soon as a VLAN is created in the vlan table, the LAN interface still accepts VLAN untagged frames but only accepts those VLAN tagged frames of which the VLAN ID corresponds with the VLAN ID that has been configured in the vlan table (see the vid element below). Other VLAN tagged frames are discarded.
2	Configure the elements of the vlan table: • name. Use this element to assign an administrative name to the VLAN. • adminStatus. Use this element to activate or deactivate the VLAN. • mode. Use this element to determine whether for the corresponding VLAN, IP packets are treated by the routing process or the bridging process. • ip. Use this element to configure the IP related parameters of the VLAN. Refer to 5.2.3 - Explaining the ip structure on page 60 for more information. • bridging. Use this element to configure the bridging related parameters in case the mode attribute is set to bridging. Refer to 11.2.6 - Explaining the bridging structure on page 279 for more information. • vlan. Use this element to configure the specific VLAN related parameters of the VLAN. See below. Refer to telindus1431Router/lanInterface/vlan on page 396 for more information.

Step	Action
3	Configure the vlan structure in the vlan table. The most important elements in this structure are: • vid. Use this element to set the VLAN ID. **Important remark** You can also enter VLAN tag 0 as VLAN ID. This is not really a VLAN, but a way to reverse the filtering: - all the untagged data is passed, internally, to VLAN 0. - all the other, tagged, data for which no VLANs are defined, are handled by the main LAN interface. This allows a set-up where a number of VLANs are VLAN switched, while other VLANs and untagged data are bridged. This is particularly interesting for VLAN based networks with Ethernet switch discovery protocols like Cisco CDP. Until now, this was not possible since the VLAN switching mode did not allow flooding packets over multiple interfaces (bridging), nor did it allow terminating management data in the device. In such set-up, the configuration looks as follows: - A first bridge group includes all VLANs that need to be switched. This bridge group is set in VLAN switching mode. - A second bridge group includes VLAN 0 and possibly also a VLAN for management of the device. - The interface VLAN table(s) include(s) entries for all switched VLANs, VLAN 0 and possibly a VLAN for management. • tagSignificance. Use this element to determine whether the VLAN tag has a local or a global significance. This element is only relevant when you set the mode element to bridging. If the tagSignificance is set to … - local, then the VLAN header is only relevant for the VLAN itself. When receiving a packet on the VLAN, the VLAN header is stripped before the packet is forwarded to the bridging engine. When transmitting a packet on the VLAN, the VLAN header is inserted. - global, then the VLAN header is not changed when forwarding packets. When connecting 2 or more Ethernet VLANs in the same bridge group, then make sure you set the tagSignificance to local, as both VLANs use different VLAN IDs. Refer to telindus1431Router/lanInterface/vlan/vlan on page 397 for more information.

12.3.3 Setting up a VLAN on the bridge group

Refer to 12.3.1 - Introducing VLANs on page 307 for an introduction.

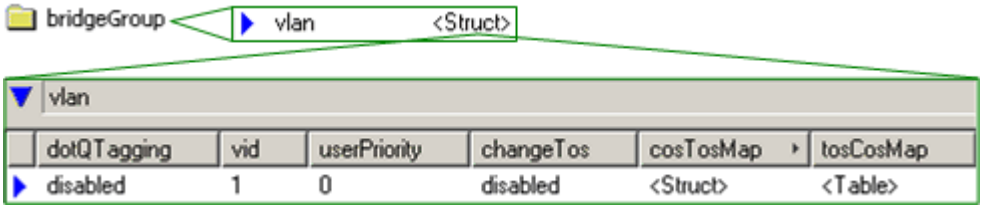
Although the Telindus 1431 SHDSL CPE bridges VLAN tagged frames when connected to a VLAN aware switch, the Telindus 1431 SHDSL CPE itself can only be managed via IP if a VLAN is configured on the bridge group. In other words, if you want that the data carried by a VLAN can be delivered to the Telindus 1431 SHDSL CPE itself (e.g. so that it can be delivered to the protocol stack, routed, etc.), then you have to configure a VLAN on the bridge group.

You can …

- either configure one single VLAN on the bridge group using the attribute telindus1431Router/bridge/bridgeGroup/vlan on page 543. Refer to Configuring a single VLAN on the bridge group on page 311.
- or configure several VLANs on the bridge group using the attribute telindus1431Router/bridge/bridgeGroup/multiVlans on page 545. Refer to Configuring multiple VLANs on the bridge group on page 312.

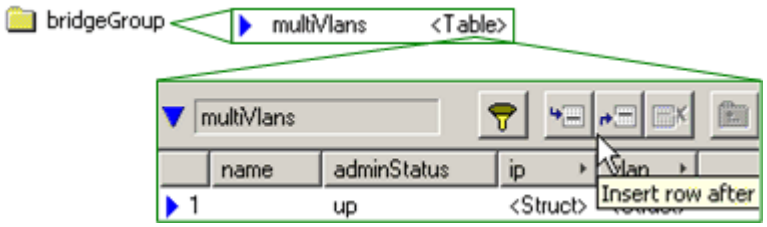
Configuring a single VLAN on the bridge group

To set up a single VLAN on the bridge group, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the bridgeGroup object and select the vlan attribute. 
2	Configure the elements of the vlan structure: • Use this element to enable or disable … - the VLAN tagging of Ethernet frames sent by the Telindus 1431 SHDSL CPE. - the recognition of VLAN tagged Ethernet frames received by the Telindus 1431 SHDSL CPE. • vid. Use this element to set the VLAN ID over which the Telindus 1431 SHDSL CPE can be managed. • userPriority. Use this element to set the user priority in the VLAN tag and this for all frames sent by the Telindus 1431 SHDSL CPE. • changeTos. Use this element to enable or disable the COS to TOS mapping. If you set the changeTos attribute to disabled, then the element cosTosMap is ignored. • cosTosMap. Use this element to determine how the VLAN user priority (COS) maps onto the IP TOS byte value. • tosCosMap. Use this element to determine how the IP TOS byte value maps onto the VLAN user priority (COS). As said before, you can *either* use the vlan attribute *or* the multiVlan attribute. So, if you set the dotQTagging element to … • enabled, then only the vlan attribute is considered and the multiVlan attribute is ignored. • disabled, then only the multiVlan attribute is considered and the vlan attribute is ignored. Refer to telindus1431Router/bridge/bridgeGroup/vlan on page 543 for more information.

Configuring multiple VLANs on the bridge group

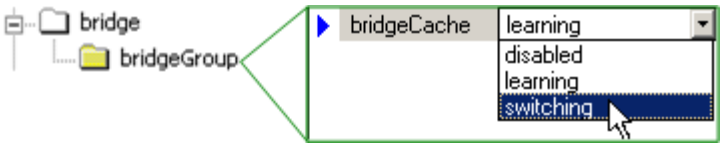
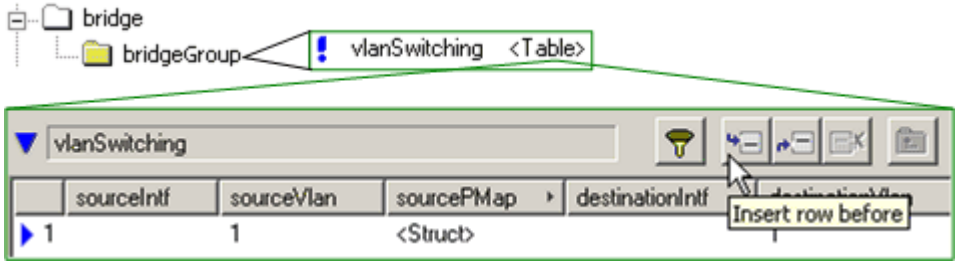
To set up multiple VLANs on the bridge group, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the bridgeGroup object, select the multiVlans attribute and add one or more entries to this table.  Use this attribute to configure the VLANs you want to set up. Add a row to the multiVlans table for each VLAN you want to set up.
2	Configure the elements of the multiVlans table: • name. Use this element to assign an administrative name to the VLAN. • adminStatus. Use this element to activate or deactivate the VLAN. • ip. Use this element to configure the IP related parameters of the VLAN. Refer to 5.2.3 - Explaining the ip structure on page 60 for more information. • vlan. Use this element to configure the specific VLAN related parameters of the VLAN. See below. Refer to telindus1431Router/bridge/bridgeGroup/multiVlans on page 545 for more information.
3	Configure the vlan structure in the multiVlans table. The elements in this structure are: • vid. Use this element to set the VLAN ID. • txCos. Use this element to set the default user priority (802.1P, also called COS) of the transmitted VLAN frames. • changeTos. Use this element to enable or disable the COS to TOS mapping. If you set the changeTos attribute to disabled, then the element cosTosMap is ignored. • cosTosMap. Use this element to determine how the VLAN user priority (COS) maps onto the IP TOS byte value. • tosCosMap. Use this element to determine how the IP TOS byte value maps onto the VLAN user priority (COS). • arp. Use this element to configure the Address Resolution Protocol (ARP) cache. Refer to telindus1431Router/bridge/bridgeGroup/multiVlans/vlan on page 546 for more information.

12.3.4 Configuring VLAN switching

Refer to 12.3.1 - Introducing VLANs on page 307 for an introduction on VLANs.

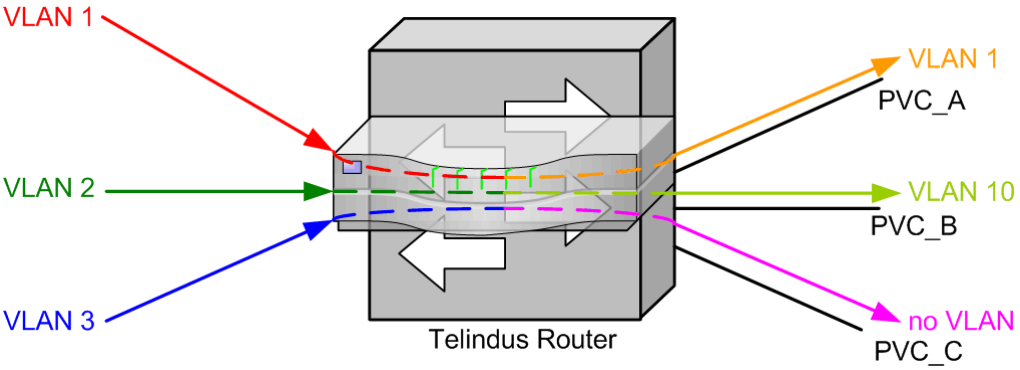
To configure VLAN switching, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the bridge/bridgeGroup object and set the bridgeCache attribute to switching. 
2	In the Telindus 1431 SHDSL CPE containment tree, go to the bridge/bridgeGroup object, select the vlanSwitching attribute and add one or more entries to this table.  Use this attribute to specify which VLANs you want to switch. Add a row to the vlanSwitching table for each VLAN you want to switch.

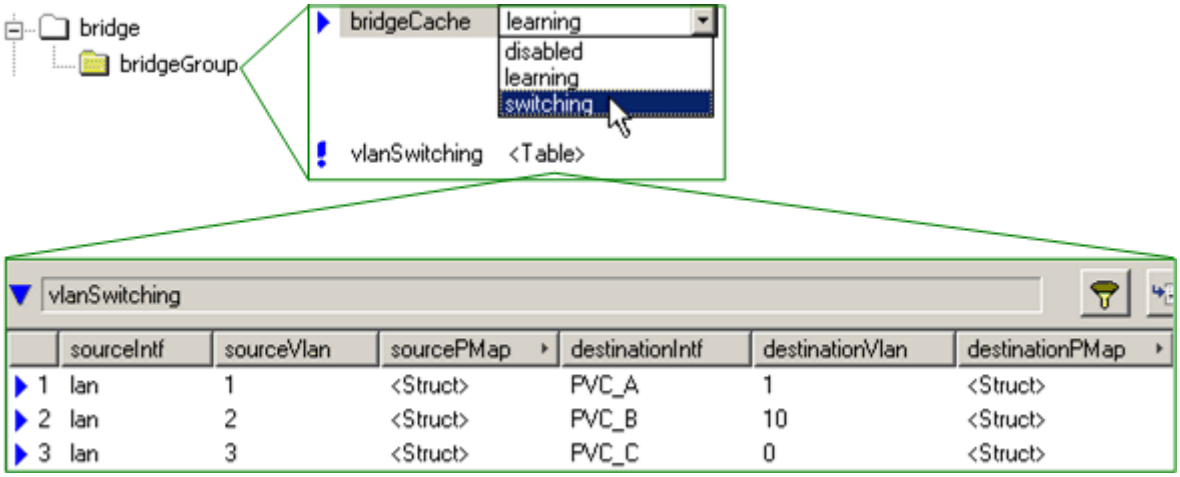
Step	Action
3	Configure the elements of the vlanSwitching table: • sourceIntf. Use this element to enter the name of the (physical) source interface which carries the VLAN that has to be switched. • sourceVlan. Use this element to enter the VLAN ID of the VLAN that has to be switched. Entering 0 as VLAN ID strips the VLAN tag of the Ethernet frame. • sourcePMap. Use this element to, if desired, remap the VLAN priorities. The priorities defined in the sourcePMap are applied after the VLAN is switched from destinationVlan to sourceVlan. • destinationIntf. Use this element to enter the name of the (physical) destination interface which carries the VLAN when it has been switched. The destination interface can also be a bridge group, in that case just enter the name of the bridge group. • destinationVlan. Use this element to enter the VLAN ID of the VLAN when it has been switched. Entering 0 as VLAN ID strips the VLAN tag of the Ethernet frame. • destinationPMap. Use this element to, if desired, remap the VLAN priorities. The priorities defined in the destinationPMap are applied after the VLAN is switched from sourceVlan to destinationVlan. **Important remarks** •Note that one row in the vlanSwitching table represents a bidirectional connection. I.e. data is switched from source to destination and vice versa. • Also note that only point-to-point connections are possible. Point-to-multipoint connections are not possible. In other words, a certain VLAN may only appear once in the vlanSwitching table. Refer to telindus1431Router/bridge/bridgeGroup/vlanSwitching on page 547 for more information on the elements of the vlanSwitching configuration attribute.

Example - configuring VLAN switching

The following figure shows the LAN interface carrying 3 VLANs that are switched to 3 different ATM PVCs. One of the VLAN IDs is kept, one is changed and one is stripped.



The following figure shows how to configure the bridge group for VLAN switching.



12.4 Configuring L2TP tunnels

This section introduces the Layer 2 Tunnelling Protocol (L2TP) and gives a short description of the attributes you can use to configure L2TP.

The following gives an overview of this section:

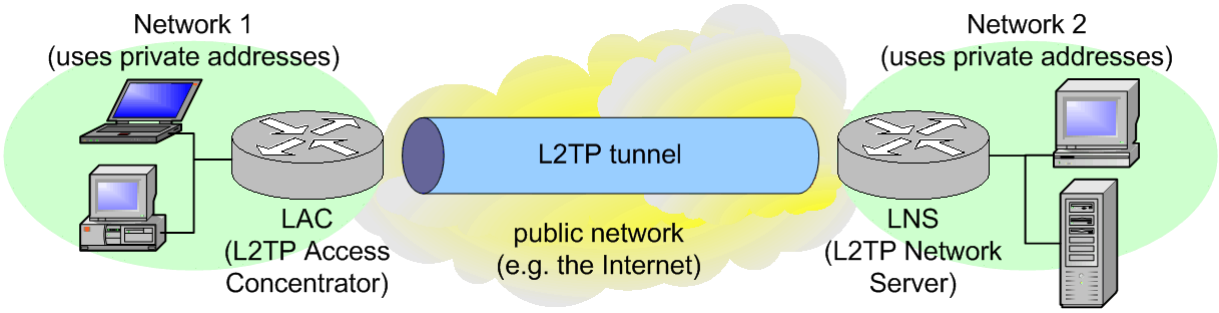
- 12.4.1 - Introducing L2TP tunnels on page 317
- 12.4.2 - Setting up an L2TP tunnel on page 319
- 12.4.3 - How does an L2TP tunnel work? on page 322
- 12.4.4 - Setting up a main and back-up tunnel on page 323

12.4.1 Introducing L2TP tunnels

What is an L2TP tunnel?

The Layer 2 Tunnelling Protocol (L2TP) is a protocol used for connecting VPNs (Virtual Private Networks) over public lines. More specific, it allows you to set up virtual PPP connections. In other words, an L2TP tunnel simulates an additional PPP interface which directly connects two routers with each other.

Concrete, using the Layer 2 Tunnelling Protocol you can connect several private and physically dispersed local networks with each other over public lines (such as the Internet) in order to create one big (virtual) local network. This without the need for address translation.



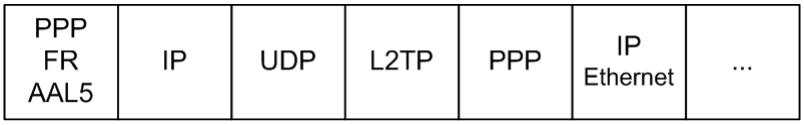
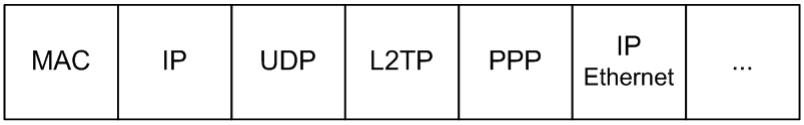
L2TP tunnel terminology

The following table gives some specific L2TP terminology:

Term	Description
L2TP Access Concentrator (LAC)	A node that acts as one side of an L2TP tunnel. It is a peer to the L2TP Network Server (LNS). Packets sent from the LAC to the LNS require tunnelling with the L2TP protocol.
L2TP Network Server (LNS)	A node that acts as one side of an L2TP tunnel. It is a peer to the L2TP Access Concentrator (LAC). The LNS is the logical termination point of a PPP session that is being tunnelled from the remote system by the LAC.
Tunnel	A tunnel exists between a LAC-LNS pair. The tunnel consists of a Control Connection and zero or more L2TP sessions. The tunnel carries encapsulated PPP datagrams and Control Messages between the LAC and the LNS.
Control Connection	A control connection operates in-band over a tunnel to control the establishment, release, and maintenance of sessions and of the tunnel itself.
Control Messages	Control messages are exchanged between LAC and LNS pairs, operating in-band within the tunnel protocol. Control messages govern aspects of the tunnel and sessions within the tunnel.

L2TP tunnel encapsulation

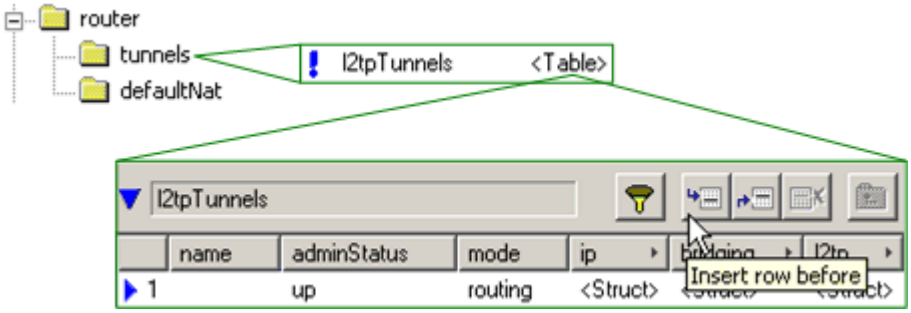
The following table shows the L2TP encapsulation on the LAN and WAN interface:

Interface	L2TP encapsulation
WAN interface	The L2TP encapsulation on the WAN interface is as follows: 
LAN interface	The L2TP encapsulation on the LAN interface is as follows: 

12.4.2 Setting up an L2TP tunnel

Refer to 12.4.1 - Introducing L2TP tunnels on page 317 for an introduction.

To set up an L2TP tunnel, proceed as follows:

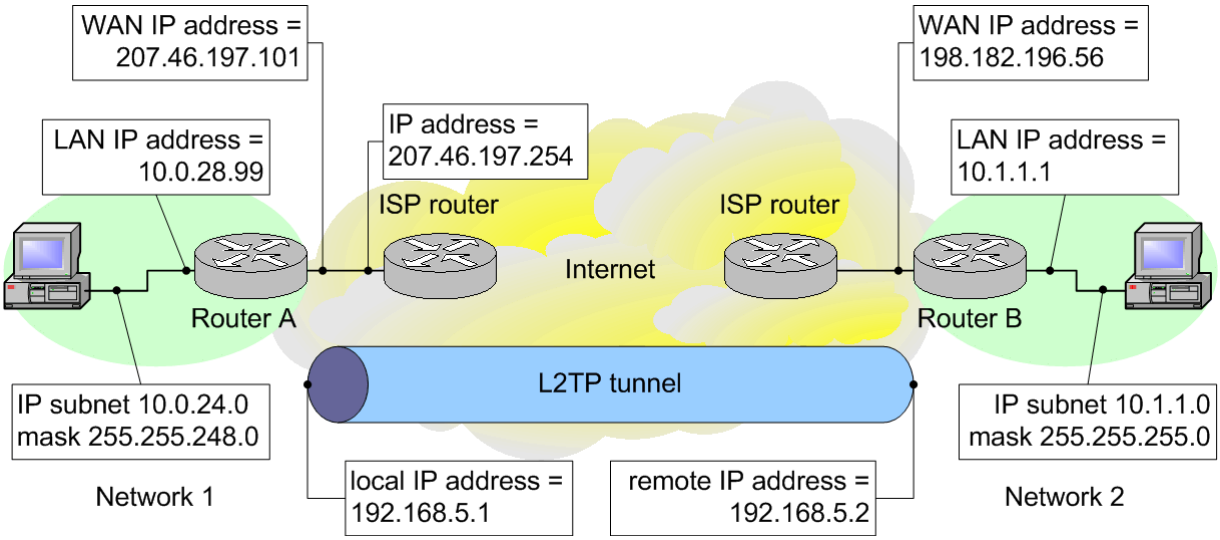
Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router/tunnels object, select the l2tpTunnels attribute and add one or more entries to this table.  Use this attribute to configure the Layer 2 Tunnelling Protocol tunnels you want to set up. Add a row to the l2tpTunnels table for each L2TP tunnel you want to set up.
2	Configure the elements of the l2tpTunnels table: • name. Use this element to assign an administrative name to the tunnel. • adminStatus. Use this element to activate or deactivate the tunnel. • mode. Use this element to determine whether for the corresponding tunnel, IP packets are treated by the routing process, the bridging process or both. • ip. Use this element to configure the IP related parameters of the tunnel. Building an L2TP tunnel is based on logical interfaces. Those logical interfaces have their own IP address. Refer to 5.2.3 - Explaining the ip structure on page 60 for more information. • bridging. Use this element to configure the bridging related parameters in case the mode attribute is set to bridging or routingAndBridging. Refer to 11.2.6 - Explaining the bridging structure on page 279 for more information. • l2tp. Use this element to configure the L2TP related parameters of the tunnel. See below. Refer to telindus1431Router/router/tunnels/l2tpTunnels on page 492 for more information.
3	Configure the l2tp structure in the l2tpTunnels table. The most important elements in this structure are: • localIpAddress. Use this element to set the IP address that serves as start point of the L2TP tunnel. • remoteIpAddress. Use this element to set the IP address that serves as end point of the L2TP tunnel. • type. Use this element to specify the tunnel type (incoming or outgoing). • mode. Use this element to set the L2TP mode of the Telindus 1431 SHDSL CPE (LAC, LNS or auto). Only use auto in case a Telindus router is located at *both sides* of the tunnel. Refer to telindus1431Router/router/tunnels/l2tpTunnels/l2tp on page 493 for more information.

Remarks

- L2TP tunnels can also be set up by an IP host. The Telindus 1431 SHDSL CPE is transparent for tunnels set up by a host.
- Multiple L2TP tunnels are possible on a single link. Currently, only one single PPP session is possible per L2TP tunnel.

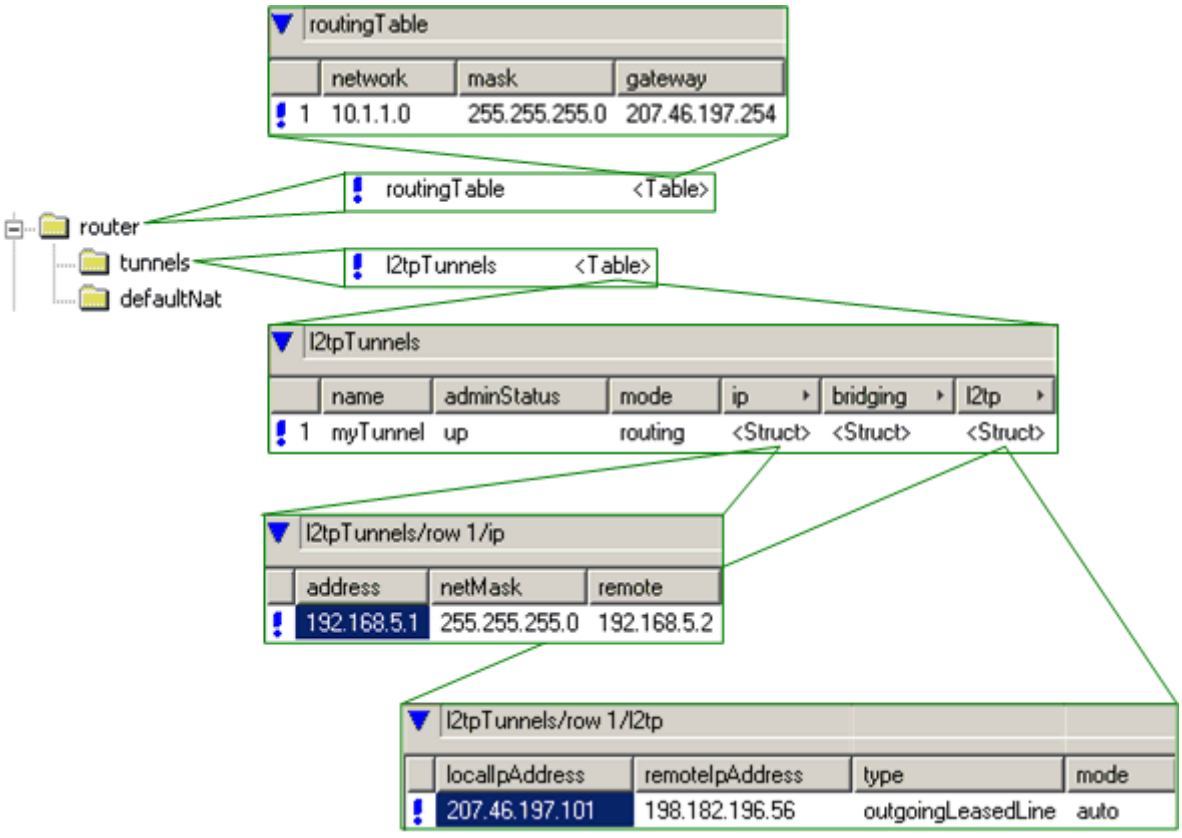
Example - configuring an L2TP tunnel

Suppose private network 1 has to be interconnected to private network 2 over the Internet. For this purpose you want to set up an L2TP tunnel between the two access routers of these private networks.



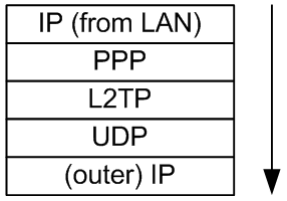
So first create a route between the WAN interfaces of Router A and B. Then set up the tunnel between the WAN interfaces of Router A and B (i.e. the tunnel start point is IP address 207.46.197.101, the tunnel end point is IP address 198.182.196.56).

The following figure shows how to set up the L2TP tunnel:



12.4.3 How does an L2TP tunnel work?

Suppose a packet coming from the LAN has a destination address for a network that is accessible through an L2TP tunnel. The following happens:

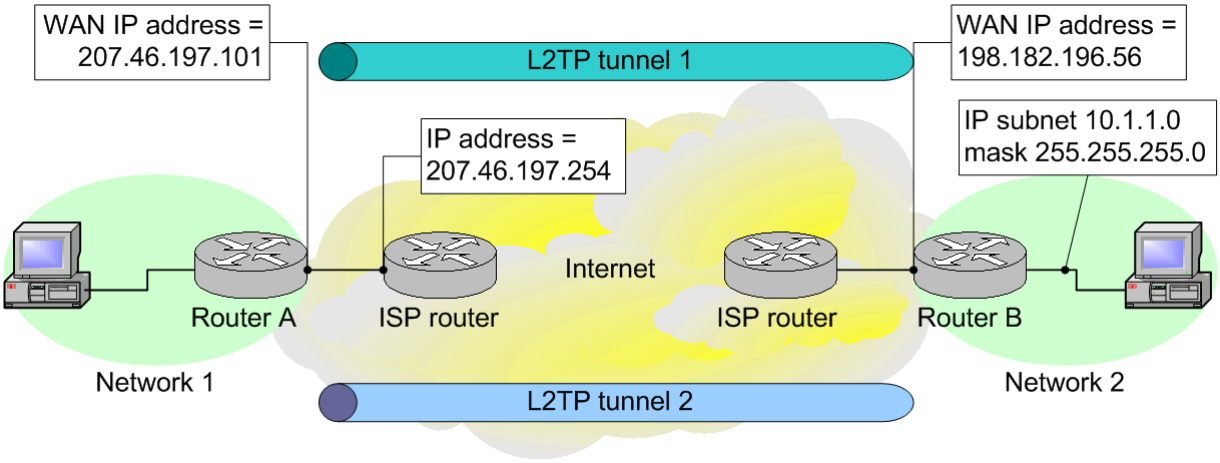
Phase	Description
1	The packet goes through the routing decision process. If the result of this decision is a route which uses the tunnel interface, then the packet is encapsulated in PPP first, then L2TP, UDP and finally IP. 
2	Then the packet goes through the routing decision process again. This time using the outer IP header.
3	The packet is routed over the Internet using the outer IP header.
4	The packet is received in the tunnel's end point, where it is then routed again using the original IP header.

12.4.4 Setting up a main and back-up tunnel

Refer to 12.4.1 - Introducing L2TP tunnels on page 317 for an introduction.

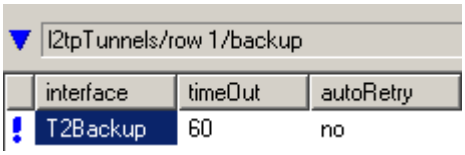
This example explains how to set up a main and a back-up tunnel. More specifically how to use the l2tpTunnels/backup element to do so.

Suppose private network 1 has to be interconnected to private network 2 over the Internet. For this purpose you want to set up an L2TP tunnel between the two access routers of these private networks. What is more, you want one main tunnel and one back-up tunnel.



Configure this example as follows:

Step	Action
1	Add two entries to the l2tpTunnels table: one entry for the main tunnel and one for the back-up tunnel. Configure these entries as described in 12.4.2 - Setting up an L2TP tunnel on page 319. l2tpTunnels name | adminStatus | mode | ip | bridging | l2tp | backup 1 T1Main up routing <Struct> <Struct> <Struct> <Struct> 2 T2Backup up routing <Struct> <Struct> <Struct> <Struct> Typically the main tunnel is of the type outgoing leased line, whereas the back-up tunnel usually is an outgoing dial tunnel.
2	Now, by adding two entries to the routingTable, create two routes to network 2: one main route (through the main tunnel) and one back-up route (through the back-up tunnel). routingTable network | mask | gateway | interface | preference | metric 1 10.1.1.0 255.255.255.0 207.46.197.254 T1Main 10 2 2 10.1.1.0 255.255.255.0 207.46.197.254 T2Backup 20 2 Differentiate the main route from the back-up route by giving them a different preference: the main route is preferred (i.e. it's preference value is lower) above the back-up route (it's preference value is higher).

Step	Action
3	Now use the backup element in the l2tpTunnels table to optimise the back-up process. Configuring the backup element allows you to quickly set up a back-up tunnel as soon as the main tunnel goes down, instead of waiting on several time-outs before the back-up tunnel is set up. For the main tunnel, you could configure the backup structure as follows:  The backup structure contains the following elements: • interface. Use this element to enter the name of the back-up tunnel. • timeOut. Use this element to set the set-up time-out of the main tunnel in seconds. If the main tunnel is not set up within the specified time-out, then the back-up tunnel is set up. • autoRetry. This element is only relevant in case the type element of the main tunnel is set to outgoingLeasedLine. Use this element to determine, if a leased line tunnel does not come up, whether it has to keep trying to come up (yes) or quit after one try (no).
4	Configuring the above results in the following: • The main route and tunnel are up. ⇒Data destined for network 2 goes over the main route/tunnel to network 2. • The main tunnel goes down. ⇒The back-up tunnel is set up immediately. Data destined for network 2 now goes over the back-up route/tunnel to network 2. • The main route and tunnel come up again. ⇒Data destined for network 2 goes over the main route/tunnel again since this is the preferred route.

Some remarks

1. The back-up mechanism only works for routing.
2. Typically the main tunnel is a leased line tunnel, whereas the back-up tunnel usually is a dial tunnel.
3. You can create an alternating back-up mechanism by letting the main tunnel refer to the back-up tunnel and vice versa. In that case you could set …
   - the backup/autoRetry of the main tunnel to no, to avoid that both main and back-up tunnel are up at the same time.
   - the l2tp/noTrafficTimeOut of the back-up tunnel to 0, to “simulate” a leased line tunnel with the advantage that this tunnel does not come up when the Telindus 1431 SHDSL CPE boots. The back-up tunnel will only come up (and stay up) at the moment it is triggered.
4. If in the situation as described in remark 3. you set the l2tp/noTrafficTimeOut of the back-up tunnel to anything else than 0, then it is best to set the backup/autoRetry of the main tunnel to yes. This because if the back-up tunnel goes down due to the no traffic time-out, then it does *not* trigger the main tunnel to come up again. Moreover, due to the main/back-up routes in the routingTable, the only available route remains the back-up route through the back-up tunnel (since the main tunnel and hence main

route stay down). However, in this case you have to keep in mind that setting up a dial tunnel can take a long time (especially when using IPSEC with IKE).

12.5 Configuring IP security

This section introduces IP security (IPSEC) and gives a short description of the attributes you can use to configure IPSEC.

The following gives an overview of this section:

- 12.5.1 - Introducing IPSEC on page 327
- 12.5.2 - Setting up an IPSEC secured L2TP tunnel using a manual SA on page 330

12.5.1 Introducing IPSEC

What is IPSEC?

IPSEC (Internet Protocol Security) is a framework for a set of protocols for security at the network or packet processing layer of network communication. Earlier security approaches have inserted security at the application layer of the communications model. IPSEC is deployed widely to implement Virtual Private Networks (VPNs). A big advantage of IPSEC is that security arrangements can be handled without requiring changes to individual user computers.

IPSEC compatibility

IPSEC on the Telindus 1431 SHDSL CPE is compatible with IPSEC on Cisco devices and on Linux.

The IPSEC modes

IPSEC features two basic modes: transport mode or tunnel mode. The Telindus 1431 SHDSL CPE currently supports L2TP tunnels over IPSEC. IPSEC is used in transport mode. I.e. traffic destined for an L2TP tunnel is secured with IPSEC (refer to RFC 3193, Securing L2TP using IPSEC).

The IPSEC protocols (ESP and AH)

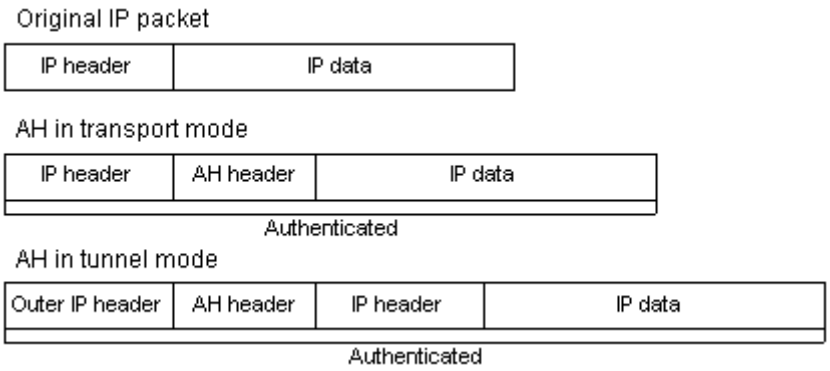
IPSEC provides two choices of security service:

- Authentication Header (AH), essentially allows authentication of the sender of data and parts of the IP header.
- Encapsulating Security Payload (ESP), allows both authentication of the sender and encryption of data as well.

The specific information associated with each of these services is inserted into the packet in a header that follows the IP packet header.

What is AH?

AH is a protocol used for authenticating a data stream. It uses a cryptographic hash function to produce a MAC from the data in the IP packet. This MAC is then transmitted with the packet, allowing the remote gateway to verify the integrity of the original IP packet, making sure the data has not been tampered with on its way through the Internet.

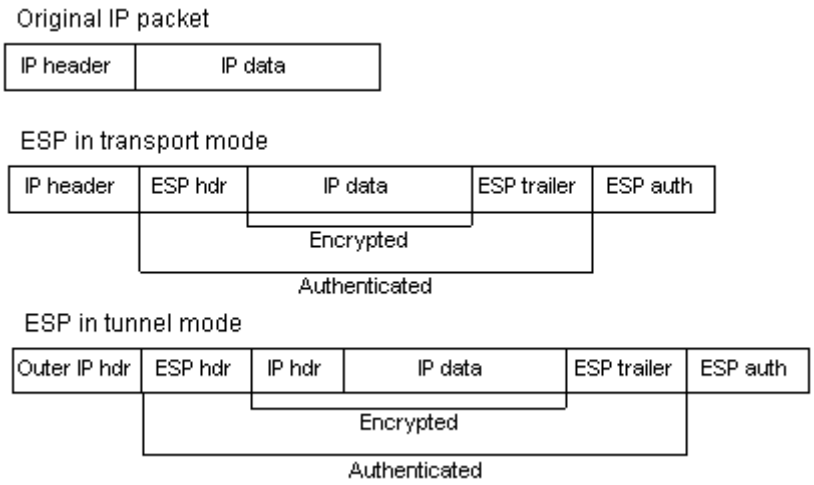


Apart from the IP packet data, AH also authenticates parts of the IP header.

The AH protocol inserts an AH header after the original IP header, and in tunnel mode, the AH header is inserted after the outer header, but before the original, inner, IP header.

What is ESP?

The ESP protocol is used for both encryption and authentication of the IP packet. It can also be used to do either encryption only, or authentication only.



The ESP protocol inserts an ESP header after the original IP header, in tunnel mode, the ESP header is inserted after the outer header, but before the original, inner, IP header.

All data after the ESP header is encrypted and/or authenticated. The difference from AH is that ESP also provides encryption of the IP packet. The authentication phase also differs in that ESP only authenticates the data after the ESP header; thus the outer IP header is left unprotected.

What is a security association (SA)?

IPSEC provides different options for performing network encryption and authentication. The two communicating nodes must determine exactly which algorithms to use (e.g. DES or 3DES for encryption, MD5 or SHA for integrity and authentication) and must share session keys. All this information is described in the Security Association (SA). In other words, the security association is simply a statement of the negotiated security policy between two devices.

An SA is, by nature, unidirectional. Hence the need for more than one SA per connection. In most cases, where either ESP or AH is used, two SAs will be created for each connection: one describing the incoming traffic and the other the outgoing. In cases where ESP and AH are used in conjunction, four SAs will be created.

What is the Security Parameter Index (SPI)?

An SPI is an arbitrary value that uniquely identifies which SA to use at the receiving host. The sending host uses the SPI to identify and select which SA to use to secure every packet. The receiving host uses the SPI to identify and select the encryption algorithm and key used to decrypt packets.

What is a manual SA?

There are two types of security associations:

- Manual SA
- Dynamic SA

The Telindus 1431 SHDSL CPE currently supports Manual SA. This requires no negotiation. All values, including the keys, are static and specified in the configuration. As a result, each peer must have the same configured options for communication to take place.

In principle, security association is unidirectional (half-duplex). I.e. one SA for the inbound traffic and one SA for the outbound traffic. The Telindus 1431 SHDSL CPE also supports full-duplex SA (one SA for both inbound and outbound traffic).

IPSEC encryption

You can encrypt the data using the Data Encryption Standard (DES or 3DES).

DES is a widely-used method of data encryption using a private (secret) key. Like other private key cryptographic methods, both the sender and the receiver must know and use the same private key. DES applies a 56-bit key to each 64-bit block of data. Triple DES applies three keys in succession.

IPSEC authentication

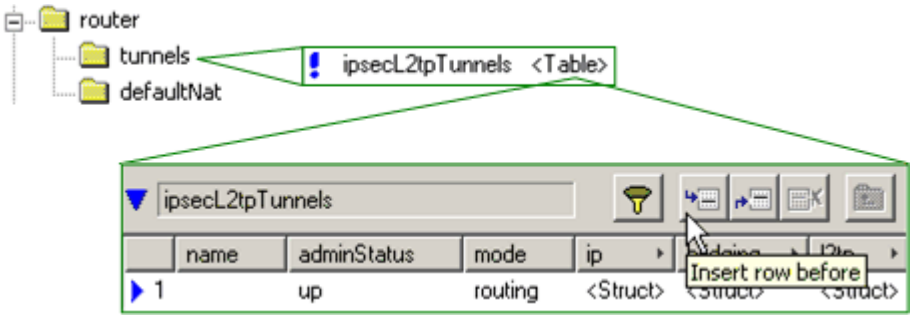
You can not only encrypt but also authenticate the data using the Keyed-Hashing for Message Authentication (HMAC).

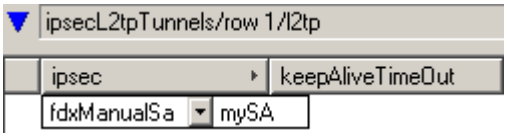
HMAC is a mechanism for message authentication using cryptographic hash functions. HMAC can be used with any iterative cryptographic hash function, e.g., MD5, SHA-1, in combination with a secret shared key.

12.5.2 Setting up an IPSEC secured L2TP tunnel using a manual SA

Refer to 12.5.1 - Introducing IPSEC on page 327 for an introduction.

In order to set up an L2TP tunnel secured with IPSEC using a manual SA, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and add a manualSA[ ] object underneath (refer to 4.4 - Adding an object to the containment tree on page 49). E.g. manualSA[mySA]
2	Now configure the attributes of the manualSA[ ] object you added in step 1 to your needs. These attribute are: • espEncryptionAlgorithm. Use this attribute to select the algorithm that will be used to encrypt the data when using IPSEC. • espEncryptionKey. Use this attribute to define the key that will be used in the encryption / decryption process when using IPSEC. • espAuthenticationAlgorithm. Use this attribute to select the algorithm that will be used to authenticate the data when using IPSEC. • espAuthenticationKey. Use this attribute to define the key that will be used in the authentication process when using IPSEC. • spi. Use this attribute to set the SPI value. Each security association must have a unique SPI value because this value is used to identify the security association. Refer to 14.9.4 - Manual SA configuration attributes on page 499 for more information.
3	In the Telindus 1431 SHDSL CPE containment tree, go to the router/tunnels object, select the ipsecL2tpTunnels attribute and add one or more entries to this table.  Use this attribute to configure the IP secured Layer 2 Tunnelling Protocol tunnels you want to set up. Add a row to the ipsecL2tpTunnels table for each IPSEC L2TP tunnel you want to set up.
4	Configure the non-IPSEC related parameters in the ipsecL2tpTunnels table as described in 12.4.2 - Setting up an L2TP tunnel on page 319. The only IPSEC related parameter is the ipsec element in the l2tp structure of the ipsecL2tpTunnels table.

Step	Action
5	In the ipsecL2tpTunnels table, go to the l2tp structure. In this structure, go to the ipsec element: • Set the first part of this element to fdxManualSA or hdxManualSA to choose between full-duplex or half-duplex manual SA (refer to telindus1431Router/router/tunnels/ipsecL2tpTunnels/l2tp/ipsec on page 497 for more information). • In the second part of this element, enter the index name of the manualSA[ ] object you added in step 1 as value of the ipsec element. By doing so, you apply the security association on the L2TP tunnel. E.g. in our example, select fdxManualSA in the first part of the ipsec element and enter the string mySA in the second part of the ipsec element. 

12.6 Configuring RADIUS

This section introduces Remote Authentication Dial-In User Service (RADIUS) and gives a short description of the attributes you can use to configure RADIUS.

The following gives an overview of this section:

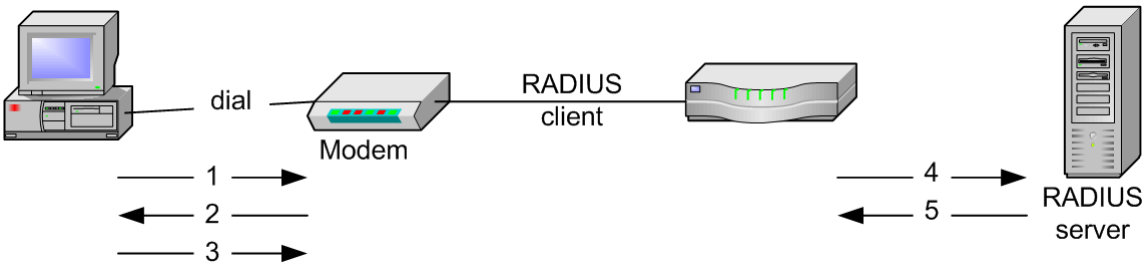
- 12.6.1 - Introducing RADIUS on page 333
- 12.6.2 - Enabling RADIUS for device access authentication on page 335
- 12.6.3 - Enabling RADIUS for network access authentication on page 337
- 12.6.4 - Enabling RADIUS for accounting on page 338
- 12.6.5 - Supported RADIUS attribute types on page 339
- 12.6.6 - Client (calling) IP settings on page 341
- 12.6.7 - NAS (called) IP settings on page 341

12.6.1 Introducing RADIUS

What is RADIUS?

Remote Authentication Dial-In User Service (RADIUS) is a client/server protocol and software that enables Network Access Servers (NAS) to communicate with a central server to authenticate dial-in users and authorize their access to the requested system or service. RADIUS allows a company to maintain user profiles in a central database that all remote servers can share. It provides better security, allowing a company to set up a policy that can be applied at a single administered network point. Having a central service also means that it's easier to track usage for billing and for keeping network statistics.

The following figure shows the interaction between a dial-in user, the RADIUS client and the RADIUS server:



1. The user initiates PPP authentication to the NAS.
2. The NAS asks for a username and a password (if PAP or CHAP is active).
3. The user replies.
4. The RADIUS client sends the username and encrypted password to the RADIUS server.
5. The RADIUS server responds with accept, reject or challenge.
6. The RADIUS client acts upon services and services parameters bundled with accept or reject.

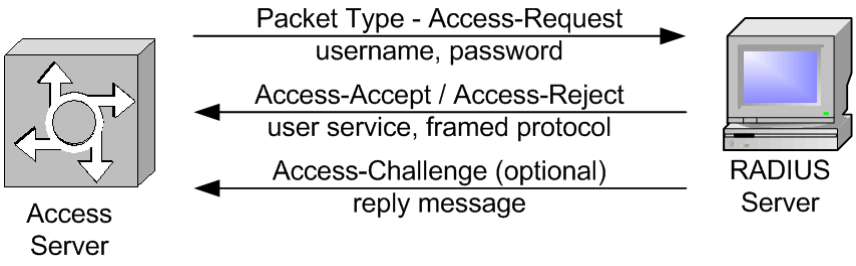
Authentication and authorisation using RADIUS

The RADIUS server can support a variety of methods to authenticate a user. When it is provided with the username and original password given by the user, it can support PPP, PAP or CHAP and other authentication mechanisms.

Typically, a user login consists of a query (Access-Request) from the NAS to the RADIUS server and a corresponding response (Access-Accept or Access-Reject) from the server:

- Access-Request. The Access-Request packet contains the username, encrypted password, NAS IP address, and port. The format of the request also provides information about the type of session that the user wants to initiate.
- Access-Reject. When the RADIUS server receives the Access-Request from the NAS, it searches a database for the username listed. If the username does not exist in the database, an Access-Reject message is sent.
- Access-Accept. In RADIUS, authentication and authorisation are coupled together. If the username is found and the password is correct, the RADIUS server returns an Access-Accept response, including a list of attribute-value pairs that describe the parameters to be used for this session. Typical parameters include service type, protocol type, IP address to assign the user (static or dynamic), access list to apply, or a static route to install in the NAS routing table. The configuration information in the RADIUS server defines what will be installed on the NAS.

The figure below illustrates the RADIUS authentication and authorization sequence:



Accounting using RADIUS

The accounting features of the RADIUS protocol can be used independently of RADIUS authentication or authorisation. The RADIUS accounting functions allow data to be sent at the start and end of sessions, indicating the amount of resources (such as time, packets, bytes, and so on) used during the session. An Internet service provider (ISP) might use RADIUS access control and accounting software to meet special security and billing needs.

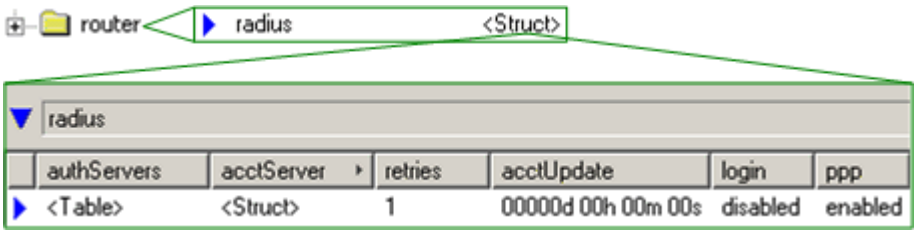
Transactions between the client and RADIUS server are authenticated through the use of a shared secret, which is never sent over the network. In addition, user passwords are sent encrypted between the client and RADIUS server to eliminate the possibility that someone snooping on an insecure network could determine a user's password.

12.6.2 Enabling RADIUS for device access authentication

Refer to 12.6.1 - Introducing RADIUS on page 333 for an introduction.

To prevent unauthorised access to the Telindus devices themselves (for management purposes), you can configure a password in the devices. However, instead of configuring the passwords in the devices themselves, you can also use a RADIUS server for this purpose.

So in order to enable device access authentication with RADIUS, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and select the radius attribute. 
2	Configure the following elements of the radius structure: • authServers. Use this element to select an authentication server. You can create a list of several authentication servers. The authServers table contains the following elements: - address. Use this element to specify the IP address of the authentication server. - secret. Use this element to set the shared secret to authenticate the transaction with the authentication server. - timeOut. Use this element to specify the authentication time-out. • retries. Use this element to specify the number of retries before selecting the next authentication server in the authServers table. • login. Use this element to set the authentication of access to the Telindus 1431 SHDSL CPE using a management application (e.g. Telnet, FTP, TFTP, TMA, etc.). No accounting data is sent to the server. The login element has the following values: - disabled. No RADIUS login authentication is done. - enabled. Login authentication is always done using a RADIUS server. Refer to step 3. - fallback. Login authentication is done using a RADIUS server. However, if the server is not available, then authentication is done using the local security table of the device.

Step	Action
3	If in step 2 you set the login element to enabled or fallback, then you have to configure usernames and associated passwords on the RADIUS server. The username and password have to be entered as follows: `"username:password"`. If the ':' is omitted, then the string is considered to be a password. Multiple passwords can be added using the same username. Access rights are sent using the RADIUS attribute CLASS (25) encoded as a string carrying a binary value. The bit definitions are: • readAccess = 00000001B • writeAccess = 00000010B • securityAccess = 00000100B • countryAccess = 00001000B (only used on aster4/5) • fileAccess = 00010000B Caution should be taken since *all* access to the device has to be authenticated by a RADIUS server.

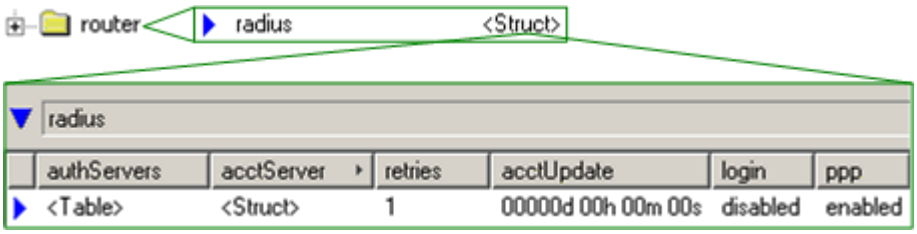
Refer to telindus1431Router/router/radius on page 484 for a complete explanation of the radius attribute.

12.6.3 Enabling RADIUS for network access authentication

Refer to 12.6.1 - Introducing RADIUS on page 333 for an introduction.

The most typical application of RADIUS is where the RADIUS server authenticates dial-in users and authorises their access to an ISP its network (in order to access the Internet).

So in order to enable network access authentication with RADIUS, proceed as follows:

Step	Action
1	Configure a PPP(oA) link towards the remote network (e.g. the ISP's network) and enable PAP or CHAP on this link. Refer to 9.4 - Configuring PPP encapsulation (in case of PPPo…) on page 167 for more information.
2	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and select the radius attribute. 
3	Configure the following elements of the radius structure: • authServers. Use this element to select an authentication server. You can create a list of several authentication servers. The authServers table contains the following elements: - address. Use this element to specify the IP address of the authentication server. - secret. Use this element to set the shared secret to authenticate the transaction with the authentication server. - timeOut. Use this element to specify the authentication time-out. • retries. Use this element to specify the number of retries before selecting the next authentication server in the authServers table. • ppp. Use this element to set the authentication of a PPP connection that uses PAP or CHAP. The ppp element has the following values: - disabled. PPP authentication is not done using a RADIUS server. It is done using the local sysName/sysSecret or sessionName/sessionSecret of the device. - enabled. PPP authentication is always done using a RADIUS server.

Note that the local configuration of username and password is ignored if a table of RADIUS servers exist. Furthermore, remote IP address and remote netmask are ignored if a RADIUS server imposes these attributes.

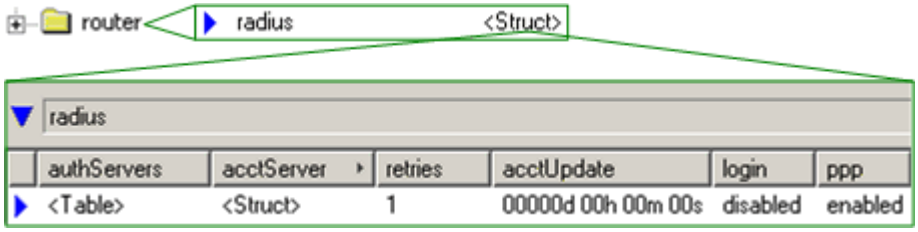
Refer to telindus1431Router/router/radius on page 484 for a complete explanation of the radius attribute.

12.6.4 Enabling RADIUS for accounting

Refer to 12.6.1 - Introducing RADIUS on page 333 for an introduction.

Together with authentication, an Internet service provider (ISP) might use RADIUS for accounting purposes (e.g. for billing or network statistics).

So in order to enable accounting with RADIUS, proceed as follows:

Step	Action
1	In the Telindus 1431 SHDSL CPE containment tree, go to the router object and select the radius attribute. 
2	Configure the following elements of the radius structure: • acctServers. Use this element to select an accounting server. You can only select one accounting server. The acctServers structure contains the following elements: - address. Use this element to specify the IP address of the accounting server. - secret. Use this element to set the shared secret to authenticate the transaction with the accounting server. - timeOut. Use this element to specify the accounting time-out. • acctUpdate. Use this element to specify the time at which an update of the accounting data should be send to the server. Set this element to 0 (default) if no update is required. Note that this is not always supported by the accounting server.

12.6.5 Supported RADIUS attribute types

This section shows which RADIUS attribute types are supported by the Telindus 1431 SHDSL CPE.

RADIUS authentication attribute types

(1) User-Name	Is sent.
(2) User-Password	Is sent in case of PAP, TELNET, FTP and TMA authentication.
(3) CHAP-Password	Is sent in case of CHAP authentication.
(4) NAS-IP-Address	Is sent (this is the IP address of the interface that received the incoming call).
(5) NAS-Port-ID	Is sent (this is the index of the interface that received the incoming call).
(7) Framed-Protocol	Is sent.
(8) Framed-IP-Address	Supported. Local configuration is overruled when received. • 255.255.255.255: client is allowed to choose an address. It must be rejected if null. • 255.255.255.254: remote IP address that is configured on the NAS is sent to the remote client. • any valid address: this address is taken as remote IP address. Also see 12.6.6 - Client (calling) IP settings on page 341 and 12.6.7 - NAS (called) IP settings on page 341 for NAS and remote client behaviour when sending/learning IP addresses and masks.
(9) Framed-IP-Netmask	Supported. Also see 12.6.6 - Client (calling) IP settings on page 341 and 12.6.7 - NAS (called) IP settings on page 341 for NAS and remote client behaviour when sending/learning IP addresses and masks.
(22) Framed-Route	Supported (1 metric).
(25) Class	Is used to send the “accessRights” when using TELNET and TMA. Is sent as a hexadecimal value.
(27) Session-Timeout	Supported.
(32) NAS-Identifier	Is sent (= sysName).
(33) Proxy-State	
(60) CHAP-Challenge	Is sent.
(62) Port-Limit	Supported in case of multilink.
(80) Message-Authenticator	HMAC MD5 authentication of access request. Is not required but is sent for security reasons.

RADIUS accounting attribute types

(40) Status-Type	Supported (values (1) Start, (2) Stop and (3) Update).
(41) Delay-Time	Supported.
(42) Input-Octets	Supported.
(43) Output-Octets	Supported.
(44) Session-ID	Supported.
(45) Authentic	Supported (always value (1) RADIUS).
(46) Session-Time	Supported.
(47) Input-Packets	Supported.
(48) Output-Packets	Supported.
(49) Terminate-Cause	Supported (values (2) Lost Carrier, (5) Session Timeout and (6) Admin Reset).
(50) Multi-Session-ID	Supported in case of multilink.
(51) Link-Count	Supported in case of multilink.

12.6.6 Client (calling) IP settings

The following table shows some cases of how and which IP addresses the client can learn on its PPP link in case of RADIUS:

Case	Description
1	IP address and mask are already configured on the client. ⇒Configured IP address and mask are used.
2	No IP address and mask are configured on the client, they are learned from the NAS. ⇒Normal case: add 3 routes (host, network and broadcast). However, if the learned mask is 255.255.255.252, then no broadcast route is added. If the learned mask is 255.255.255.255, then only a host route is added. ⇒If the gatewayPreference is not 0, then a default gateway is added via the PPP interface with the configured preference. ⇒If the PPP link goes down, then remove all the routes.
3	No IP address is configured on the client. IP address is learned from the NAS, the mask not. ⇒Configured IP address is used. ⇒Set mask to 255.255.255.255.
4	The client is configured in unnumbered mode (an IP address and mask are taken from another interface for which the IP address and mask is configured). ⇒IP address and mask of the referenced interface are used.

12.6.7 NAS (called) IP settings

The following table shows some cases of how and which IP addresses the NAS sets on its PPP link in case of RADIUS:

Case	Description
1	An IP address and mask is configured or unnumbered mode is configured. The remote client requests an IP address and mask. ⇒If the remote IP address does not fall within the network defined by the own IP address and mask, then reject the VSO option 0.0.0.0 from the other side. (E.g. remote IP = 10.0.0.1 and own IP = 192.168.0.1 / 255.255.255.0.) ⇒If (remote IP address and mask) = (local IP address and mask), then a host route is added for the remote IP address to make sure that the remote can be reached (via proxy ARP when the NAS is in unnumbered mode).

12.7 Configuring QoS

This section introduces Quality of Service (QoS) and, using schematical drawings, tries to shows which attributes you can use to configure QoS.

The following gives an overview of this section:

- 12.7.1 - Introducing QoS on page 343
- 12.7.2 - IP QoS on page 344
- 12.7.3 - VLAN QoS on page 345
- 12.7.4 - QoS on an Ethernet interface on page 345
- 12.7.5 - QoS on a PPP interface without fragmentation on page 346
- 12.7.6 - QoS on a PPP interface with fragmentation on page 346
- 12.7.7 - QoS on a multilink PPP interface with fragmentation on page 347
- 12.7.8 - QoS on a Frame Relay interface without fragmentation on page 348
- 12.7.9 - QoS on a Frame Relay interface with fragmentation on page 348
- 12.7.10 - QoS on a multilink Frame Relay interface without fragmentation on page 349
- 12.7.11 - QoS on a multilink Frame Relay interface with fragmentation on page 350
- 12.7.12 - Frame Relay fragmentation options on page 350
- 12.7.13 - QoS on an ATM interface on page 351
- 12.7.14 - QoS on an ATM IMA interface on page 351
- 12.7.15 - QoS on traffic within a VPN tunnel on page 352

12.7.1 Introducing QoS

What is QoS?

Quality of Service (QoS) is the capability of a network to provide better service to certain network traffic over various technologies (e.g.Frame Relay, ATM, Ethernet and IP networks that use any or all of these underlying technologies). The primary goal of QoS is to provide priority including dedicated bandwidth, controlled jitter and latency, and improved loss characteristics. Also important is making sure that providing priority for one or more flows does not make other flows fail.

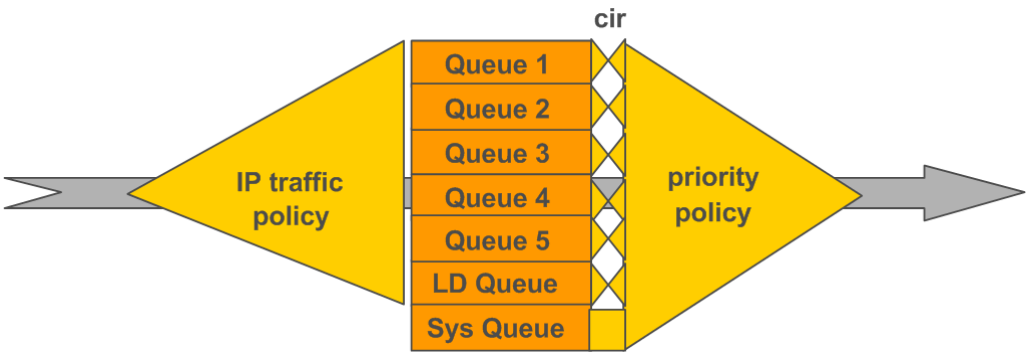
QoS is not one attribute that you can set to “low”, “medium” or “high” quality. QoS is a *collection* of configuration attributes located on different levels (e.g. queueing, PPP fragmentation, bandwidth control, etc.).

The following table gives an overview of the features that can be used for QoS:

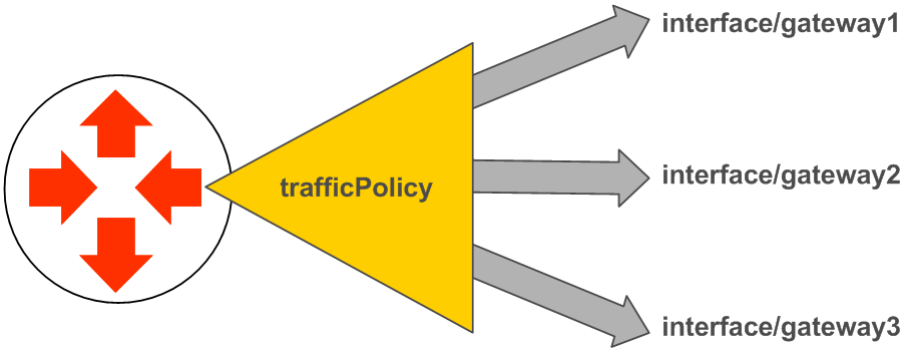
Protocol	Feature
All	7 queues: 5 user configurable queues, a low delay queue and a system queue.
All	Priority policies: FIFO, round robin, absolute priority, WFQ, low delay WFQ.
All	Bandwidth control per queue with CIR values.
IP	IP traffic classification based on access lists (trafficShaping), tosDiffServ & tosMapped.
VLAN	VLAN traffic classification based on 802.1P bits.
PPP	PPP fragmentation.
PPP	PPP multi-class.
PPP	Improved load balancing for MLPPP.
Frame Relay	Frame Relay fragmentation.
Frame Relay	CIR / EIR on outgoing traffic.
Frame Relay	CIR / EIR on incoming traffic.
ATM	UBR traffic class.

12.7.2 IP QoS

- 7 queues per interface.
  - Queue 1 up to 5.
  - Low delay queue.
  - System queue for e.g. control protocols (PPP LCP, Frame Relay LMI, ATM OAM, …).
  - CIR is configurable per queue (except for the system queue).
- Traffic policy: maps IP traffic to a queue.
  - Traffic shaping: classification on IP addresses, IP protocol, UDP/TCP port numbers and TOS bits.
  - diffServ: fixed mapping to queues and 3 drop levels based on 2 TOS bits.
  - TOS mapped: configurable mapping on TOS bits only.
- Priority policy: defines policy to empty the queues.
  - FIFO, round robin, absolute priority, WFQ, low delay WFQ.
  - Bandwidth control per queue (CIR).
  - System queue always has absolute priority.

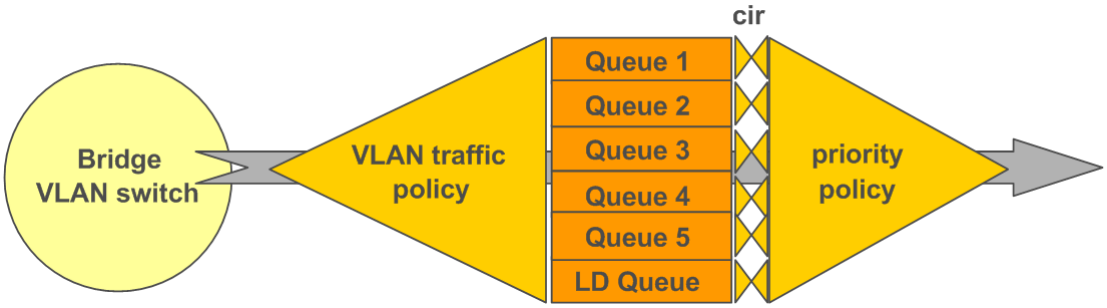


- Policy based routing: routing is based on higher layer protocols.
  - IP addresses, IP protocol, UDP/TCP port numbers and TOS bits.



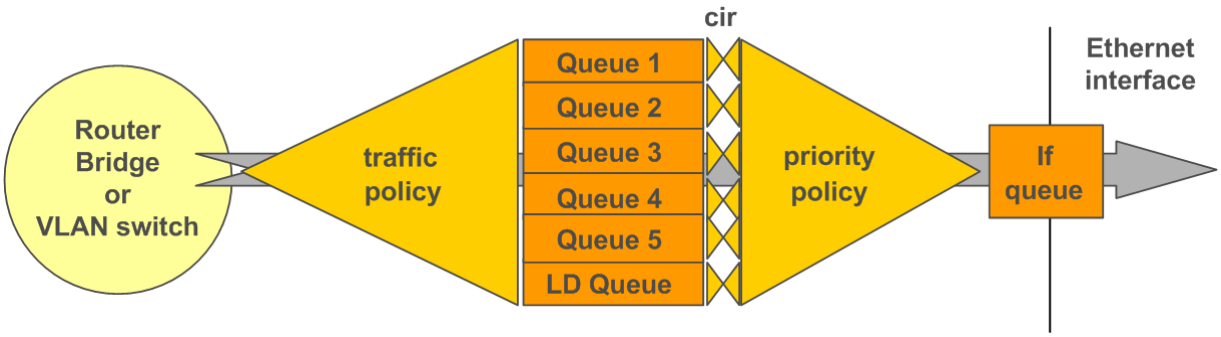
12.7.3 VLAN QoS

- Only in case of bridging or VLAN switching mode.
- Only applicable on VLAN packets (using the P bits).
- Traffic policy based on P bits value.
- IP TOS to VLAN COS mapping during tagging.



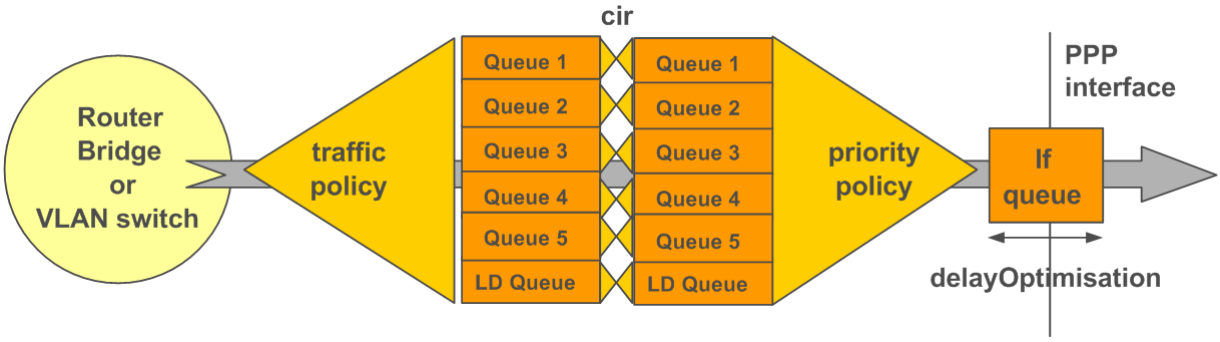
12.7.4 QoS on an Ethernet interface

- Traffic policy and priority policy are configured on physical interface level.
- CIR is configurable per queue.



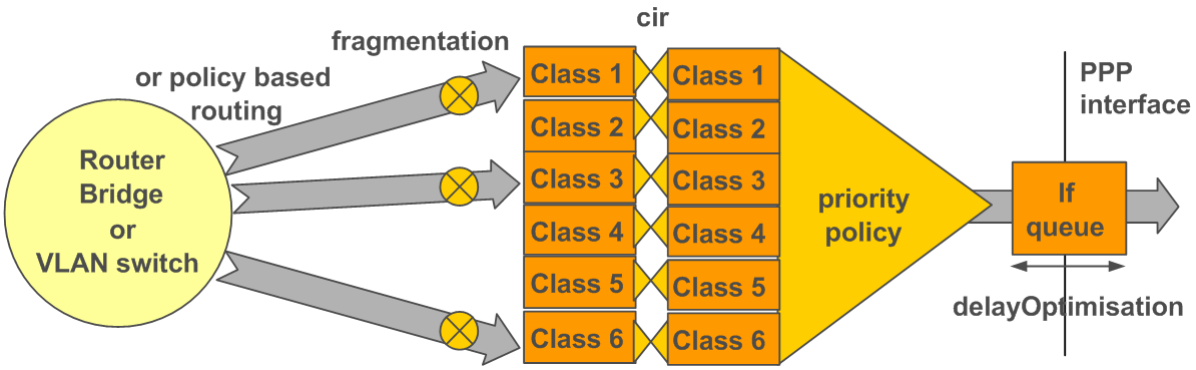
12.7.5 QoS on a PPP interface without fragmentation

- Traffic policy and priority policy are configured on physical interface level.
- CIR is configurable per queue.
- When setting the attribute delayOptimisation to lowSpeedLinks, then the interface queue length is reduced. This is particularly interesting for low speed links.



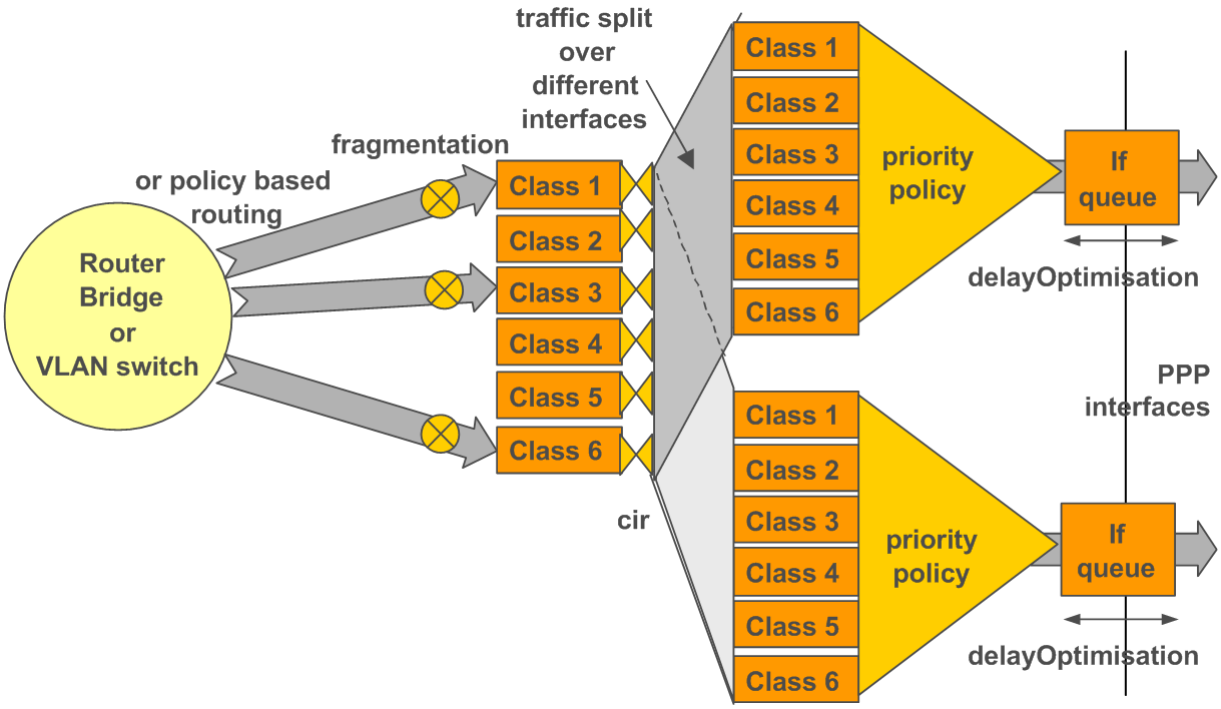
12.7.6 QoS on a PPP interface with fragmentation

- Fragmentation on PPP is mostly used for QoS (especially if the link speed is below 2 Mbps).
- Fragmentation can be enabled or disabled per interface (not per class).
- Use multiclass PPP for QoS.
  - Set up a PPP bundle to be able to use multiclass.
  - Each class is like a separate interface.
  - Each class uses one priority queue (configurable per class). There is no need to apply a traffic policy (use the default queue).
  - Apply a priority policy on the physical interface.



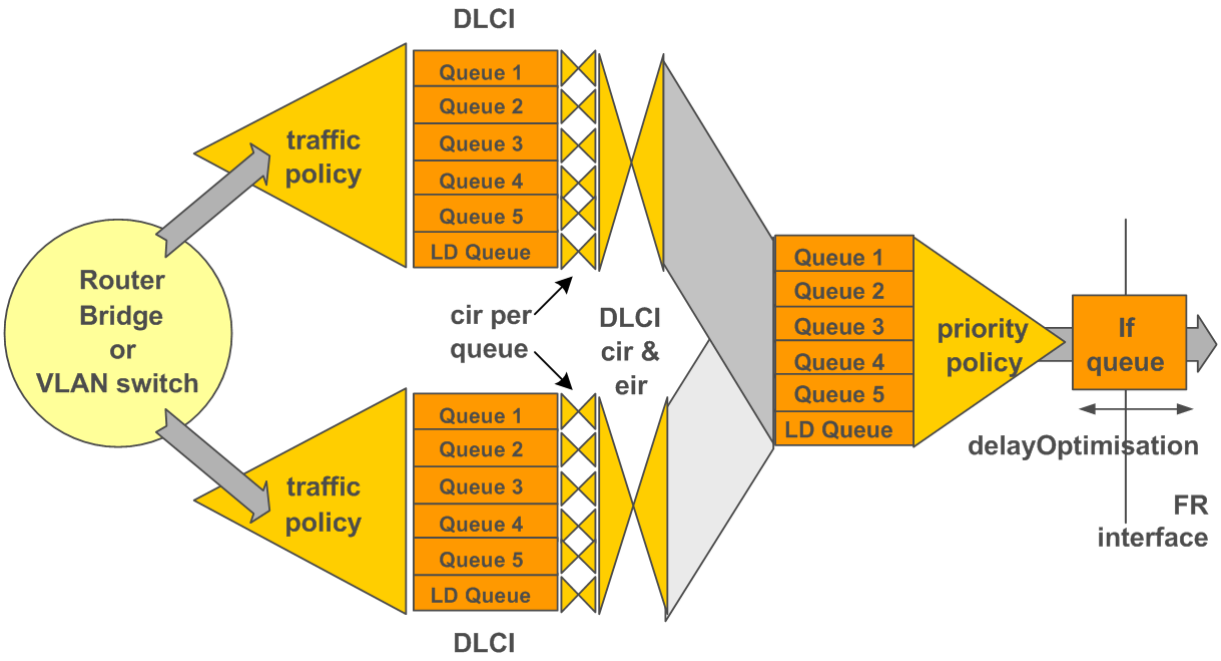
12.7.7 QoS on a multilink PPP interface with fragmentation

Similar as for 12.7.6 - QoS on a PPP interface with fragmentation on page 346, except that now you use several physical interfaces.



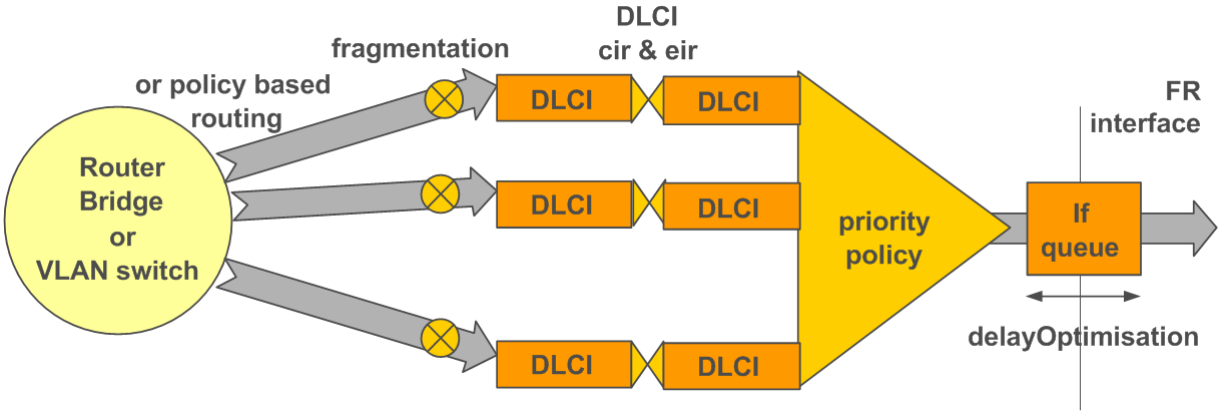
12.7.8 QoS on a Frame Relay interface without fragmentation

- Traffic policy is configured on DLCI level.
- Priority policy is configured on physical interface level.
- CIR is configurable per queue and per DLCI.



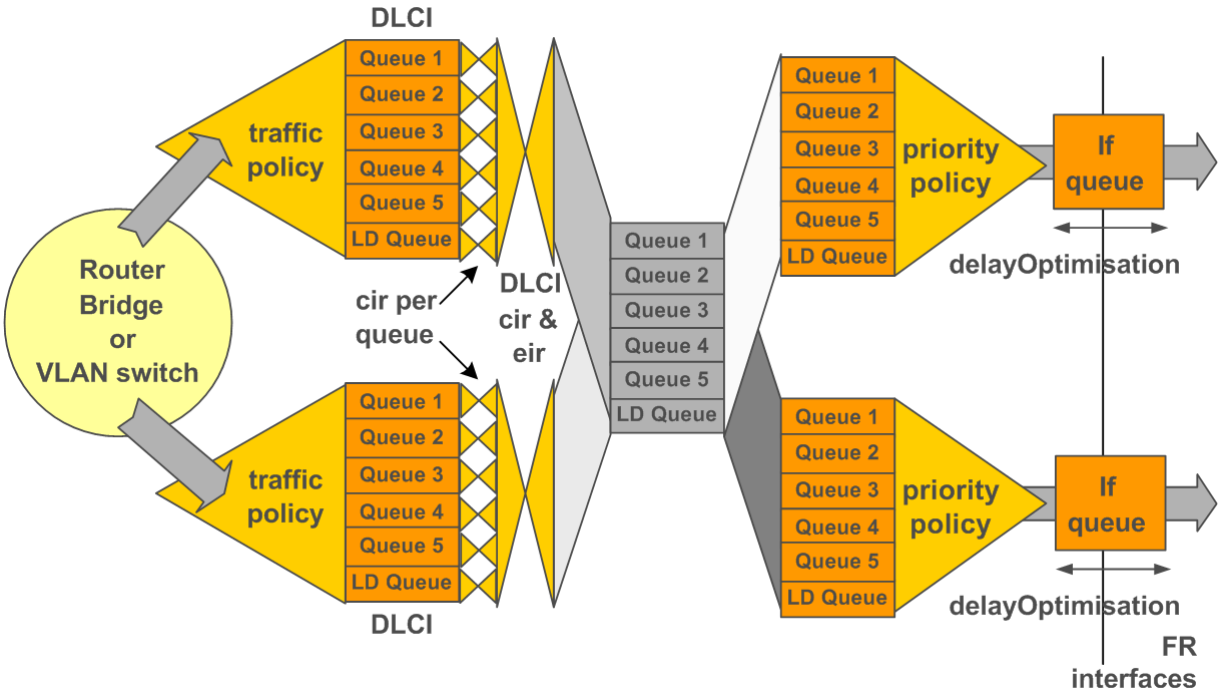
12.7.9 QoS on a Frame Relay interface with fragmentation

- Use multiple DLCIs per destination for different traffic classes.
- Each DLCI uses one priority queue (configurable per DLCI). There is no need to apply a traffic policy (use the default queue).
- Priority policy is configured on physical interface level.



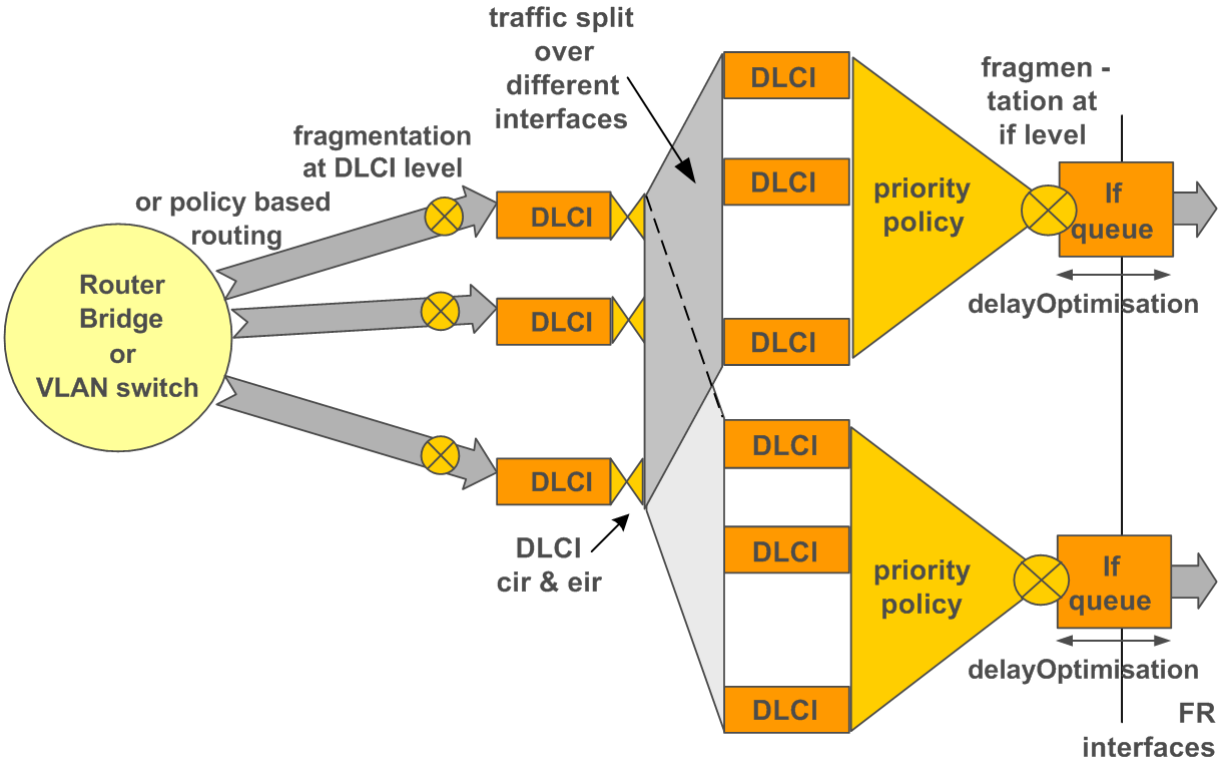
12.7.10 QoS on a multilink Frame Relay interface without fragmentation

- Set up a Frame Relay bundle.
- Traffic policy is configured on DLCI level.
- Priority policy is configured on physical interface level.
- CIR is configurable per queue and per DLCI.



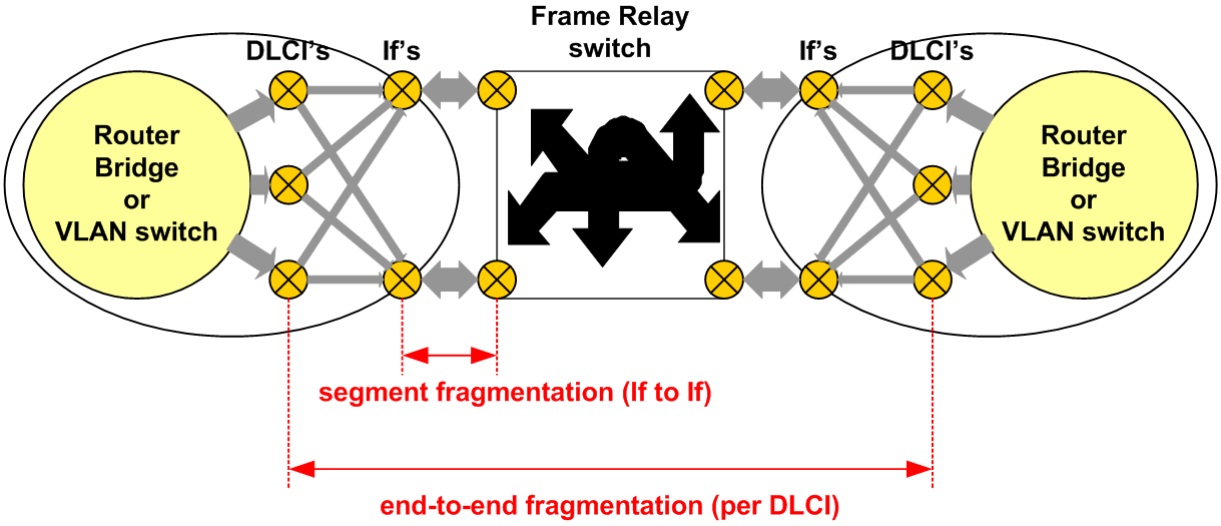
12.7.11 QoS on a multilink Frame Relay interface with fragmentation

- Set up a Frame Relay bundle.
- Apply the same QoS principles on the bundle interface as on a physical interface.
- Note that Cisco routers do not support fragmentation on a multilink Frame Relay interface.



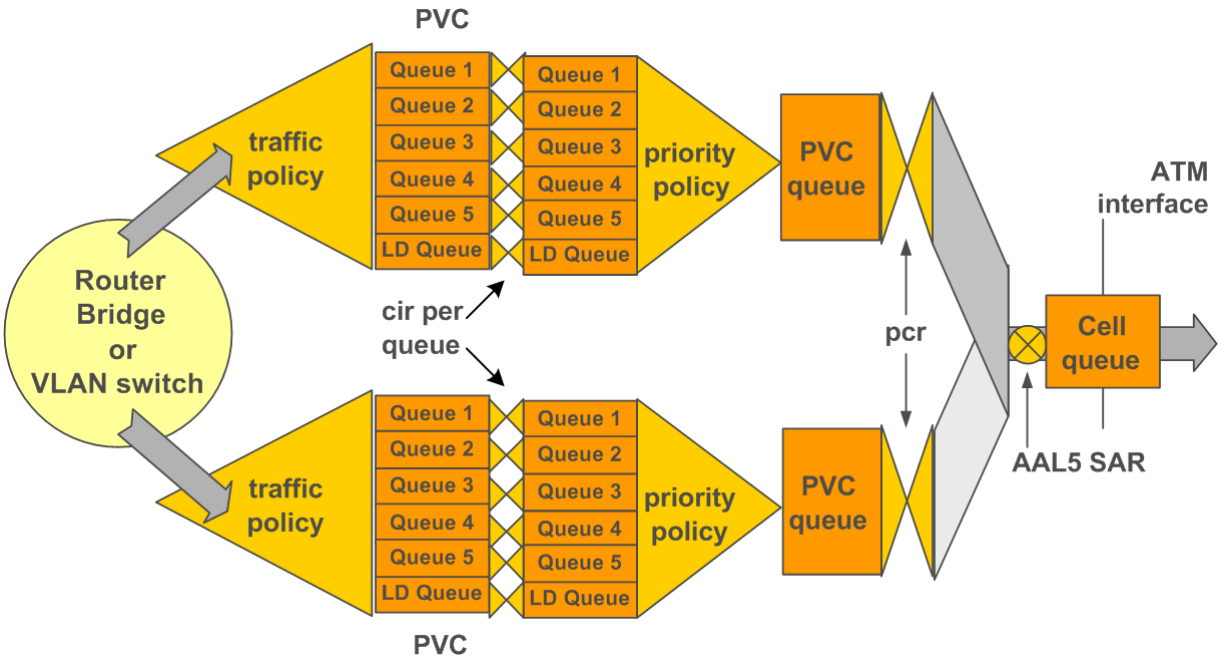
12.7.12 Frame Relay fragmentation options

- End-to-end fragmentation = fragmentation at DLCI level.
- Segment fragmentation = fragmentation at interface level (up to a switch).

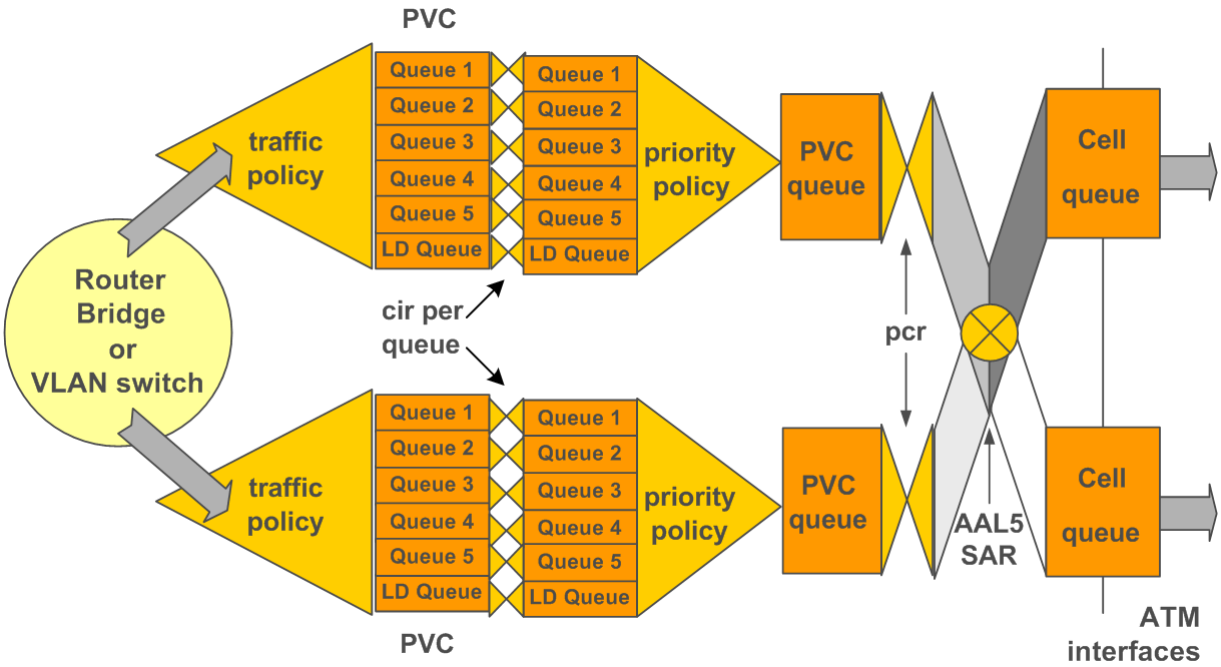


12.7.13 QoS on an ATM interface

- Each PVC behaves like a physical interface.
- Traffic policy and priority policy are configured on PVC level.
- CIR is configurable per queue.
- PCR is configurable per PVC.
- AAL5 SAR (= fragmentation) occurs at the end.

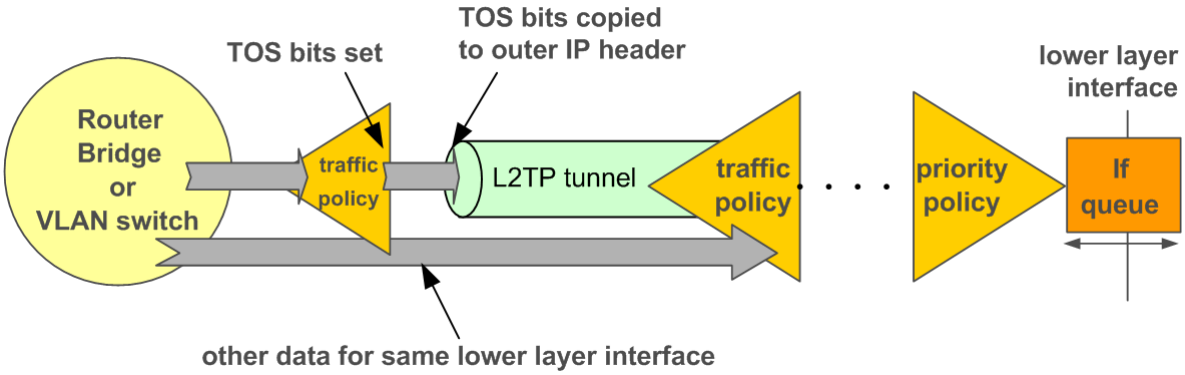


12.7.14 QoS on an ATM IMA interface



12.7.15 QoS on traffic within a VPN tunnel

- Set up an L2TP or L2TP IPSec tunnel.
- Applying a traffic policy on the traffic destined for the tunnel is only useful for setting the TOS (DSCP) bits (the priority field remains unused). So set the copyTos attribute in the l2tp structure to on.
- Create a traffic and priority policy on the lower layer interface. These policies are used on the TOS values you have set with first traffic policy.



13 Configuration examples

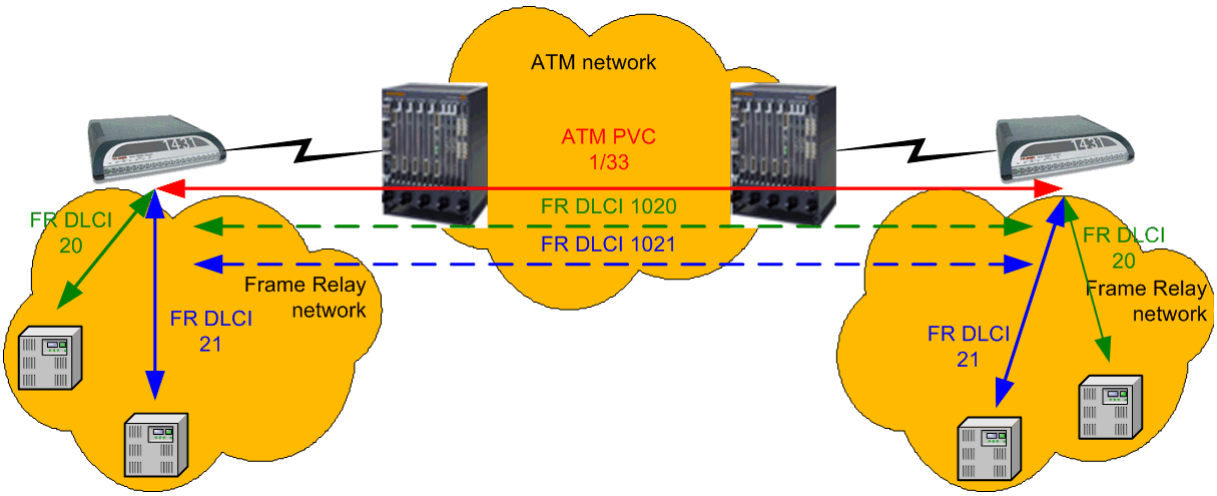
This chapter shows some basic configuration examples for the Telindus 1431 SHDSL CPE. This allows you to get acquainted with the way the Telindus 1431 SHDSL CPE has to be configured.

The following gives an overview of this chapter:

- Setting up FRF.5 links on page 354
- Setting up FRF.8 links on page 356
- Setting up combined CES E1 and IP services on page 358
- Setting up ATM over E1 on page 375

13.1 Setting up FRF.5 links

Set-up



Set-up description

Two Frame Relay DLCIs need to be transported over an ATM network. They are both put in the same ATM PVC for transport over the ATM network. Also the LMI needs to be transported over the ATM network.

Configuration description

The following configuration can be used for both Telindus 1431 SHDSL CPEs:

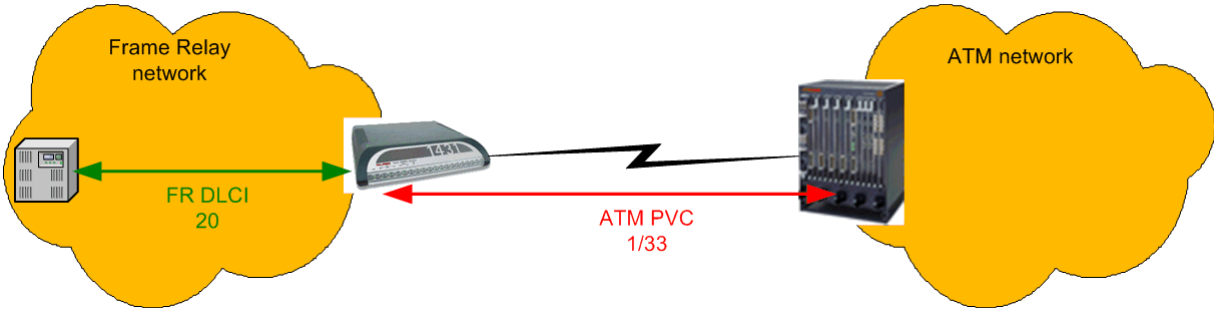
action "Load Default Configuration"

```
SET
{
    SELECT wanInterface
    {
      SELECT atm
      {
        LIST
        {
          frAtm =
          {
# the following defines the first FRF5 link
            [a] =
            {
              name = "frf5_1"
# the following sets the ATM PVC parameters of the first FRF5 link
# since 2 DLCIs are put in one PVC, we have to make sure that the bandwidth
# of the PVC is set high enough so that it can contain both DLCIs
              atm =
              {
                vpi = 1
                vci = 33
                peakCellRate = 128kbps
              }
# the following sets the Frame Relay DLCI parameters of the first FRF5 link
# the dlci element sets the DLCI number of the DLCI in the local Frame Relay network
# the destinationDlci set the DLCI number of the DLCI that is encapsulated in the
# ATM PVC
              frameRelay =
              {
                dlci = 20
                destinationDlci = 1020
                cir = 64000
              }
            }
# the following defines the second FRF5 link
            [a] =
```

```
            {
              name = "frf5_2"
# the following sets the ATM PVC parameters of the second FRF5 link
# since the second FRF5 link is put in the same ATM PVC as the first one,
# only the vpi and vci elements of the atm structure have to be set
# (in our example vpi=1/vci=33, the same as for the first FRF5 link)
# the other elements of the atm structure are not taken into account
# (this means that the QoS parameters of the ATM PVC have to be configured
# in the first table entry)
              atm =
              {
                vpi = 1
                vci = 33
              }
# the following sets the Frame Relay DLCI parameters of the second FRF5 link
              frameRelay =
              {
                dlci = 21
                destinationDlci = 1021
                cir = 64000
              }
            }
          }
# the following allows for LMI to be transported over the ATM network along with
# the Frame Relay DLCIs
          frLmiAtm =
          {
            [a] =
            {
# specify the VPI and VCI of the ATM PVC over which you want to transport the LMI
              vpi = 1
              vci = 33
# the following sets the LMI mode to auto
              lmi =
              {
                mode = "auto"
              }
            }
          }
        }
      }
    }
    SELECT g703
# the encapsulation on the G703 interface is set to Frame Relay by default
    {
      LIST
      {
# since this is a DSLAM setup, the 1431 is configured for slaving to the DSLAM
# for clocking and line (speed) parameters
# i.e. SHDSL channel mode to remote (default), auto line speed (default),
# slave clocking (see below)
        clocking = "slaveOnNetwork"
      }
    }
}
action "Activate Configuration"
```

13.2 Setting up FRF.8 links

Set-up



Set-up description

A Frame Relay network needs interface with an ATM network. So a Frame Relay DLCI is “translated” into an ATM PVC.

Configuration description

The configuration of the Telindus 1431 SHDSL CPE looks as follows:

```
action "Load Default Configuration"
SET
{
    SELECT wanInterface
    {
      SELECT atm
      {
        LIST
        {
# the following configures the FRF8 link
          frAtm =
          {
            [a] =
            {
              name = "Frf8Link"
              mode = "frf8"
# the following sets the ATM parameters
              atm =
              {
                vpi = 1
                vci = 33
                peakCellRate = 640kbps
              }
# the following sets the Frame Relay parameters
              frameRelay =
              {
                dlci = 20
                cir = 640000
              }
            }
          }
        }
      }
    }
    SELECT g703
    {
      LIST
      {
# since this is a DSLAM setup, the 1431 is configured for slaving to the DSLAM
# for clocking and line (speed) parameters
# i.e. SHDSL channel mode to remote (default), auto line speed (default),
# slave clocking (see below)
        clocking = "slaveOnNetwork"
      }
    }
}
action "Activate Configuration"
```

13.3 Setting up combined CES E1 and IP services

The Telindus 1431 SHDSL CPE can either be used in a point-to-point configuration or in combination with a DSLAM.

The Telindus 1431 SHDSL CPE always uses ATM cells on the SHDSL line. In case of a clear channel service (CES, E1 or serial based), the Telindus 1431 SHDSL CPE uses AAL1 and a CBR PVC to offer the service. CES works in synchronous mode, i.e. the clock for the clear channel service is derived from the ATM network.

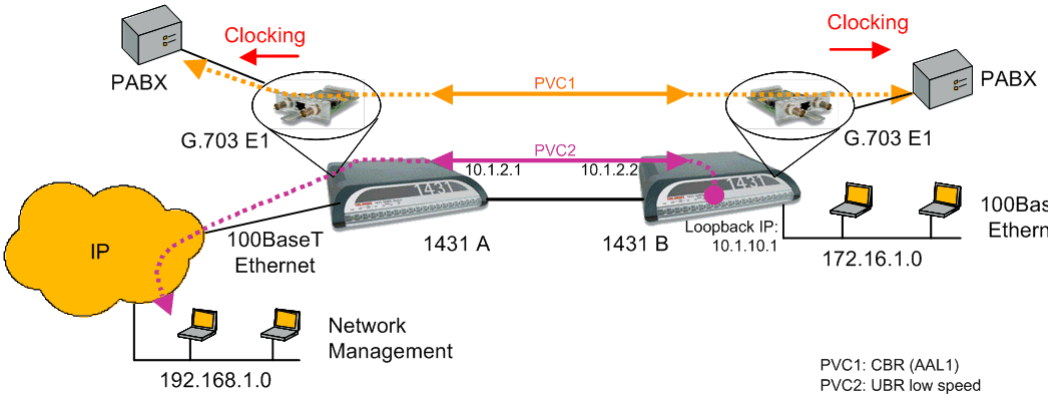
In case of an IP service, which is delivered on a 10/100 Base-T port, the Telindus 1431 SHDSL CPE uses AAL5. If this IP service is for management purposes, a dedicated low speed AAL5 UBR PVC can be set up.

This section shows 3 examples of combined CES E1 and IP services:

- 13.3.1 - Combined unframed CES E1 and IP services in a point-to-point set-up on page 359
- 13.3.2 - Combined framed CES E1 and IP services in a point-to-point set-up on page 364
- 13.3.3 - Combined framed CES E1 and IP services in a DSLAM set-up on page 371

13.3.1 Combined unframed CES E1 and IP services in a point-to-point set-up

Set-up



Set-up description

The drawing shows a point-to-point set-up where a CES connection is combined with an IP connection:

- The CES connection carries the data from the central PABX to the remote PABX. Suppose that for the CES link a complete *unframed* E1 data stream has to be transmitted over a single pair SHDSL line.
- The IP connection carries management data from the central management station to the remote Telindus 1431 SHDSL CPE (Telindus 1431 SHDSL CPE B).

The other major issues of this set-up are:

Issue	Description
bandwidth	The normal available bandwidth on a single standard SHDSL line is 2304 kbps. By using an additional Z-bit in the SHDSL framing, this bandwidth can be extended to 2312 kbps. A full unframed E1 is 2048 kbps. When taking the ATM and the AAL overhead into account, then the required bandwidth on the SHDSL line is: 2048 * 53 / 47 = 2309 kbps. This means that a full unframed E1 can be transported by the Telindus 1431 SHDSL CPE, under the condition that the additional Z-bit is enabled. As a result, only a very limited bandwidth is still available for management. For this purpose a special type of PVC, the low speed PVC, can be configured. This type of PVC only uses 2211 bps, fitting into the small spare bandwidth that is still available. With this, the complete single pair bandwidth is occupied.
clocking	In case of CES in a point-to-point set-up, one of the Telindus 1431 SHDSL CPEs should be configured as “central” (creating the master clock for the ATM cells) and the other as “remote” (slaving on the master clock from the “central” unit). In order not to have clock-slips, both applications connected to the leased line interface should be configured to slave on the clock provided by the Telindus 1431 SHDSL CPE.
signalling support	In case of a point-to-point set-up, it is possible to transport any type of signalling transparently in timeslot 16. This means that both CAS (Circuit Associated Signalling) and CCS (Common Circuit Signalling) are supported.

Configuration description

The configuration of the following devices is listed below:

- Telindus 1431 SHDSL CPE A on page 360
- Telindus 1431 SHDSL CPE B on page 362

Telindus 1431 SHDSL CPE A

```
action "Load Default Configuration"
SET
{
    LIST
    {
      sysName = "1431_A"
    }
    SELECT lanInterface
    {
      LIST
      {
# the following sets the IP address of the LAN interface and sets the mode to routing
        ip =
        {
          address = 192.168.1.1
        }
        mode = "routing"
      }
    }
    SELECT wanInterface
    {
      SELECT atm
      {
        LIST
        {
# the following sets up the low speed management PVC
          lowSpeedPvc =
          {
            [a] =
            {
              name = "MgtPvc"
              ip =
              {
                address = 10.1.2.1
                netMask = 255.255.255.252
                remote = 10.1.2.2
              }
              atm =
              {
                vpi = 2
                vci = 100
              }
            }
          }
# the following sets up the CES PVC
          ces =
          {
            [a] =
            {
              name = "Ces4Pabx"
              atm =
              {
                vpi = 1
                vci = 100
              }
              intfName = "g703_1"
            }
          }
        }
      }
      SELECT line
      {
        LIST
        {
# the following sets the SHDSL line channel to central
# the channel of the remote 1431 should be set to remote
```

```
          channel = "central"
# the extra Z-bit is enabled by default (maxNrOfZBits = 1)
# the following explicitly sets the line speed to the maximum speed
          minSpeed = "2304kbps"
# (the default value of the maxSpeed attribute is 2304kbps)
        }
      }
    }
    SELECT g703
    {
      LIST
      {
# the clocking mode is set to internal clocking by default
# the connected application and the remote 1431 should slave on this clock
# the framing mode is set to unframed mode by default
      }
      SELECT channel["g703_1"]
      {
        LIST
# the following sets the encapsulation on the G.703 interface to CES
        {
          encapsulation = "ces"
        }
      }
    }
    SELECT router
    {
      LIST
      {
# the following defines a route to the remote 1431 for the management data
        routingTable =
        {
          [a] =
          {
            network = 10.1.10.0
            interface = "MgtPvc"
          }
        }
      }
    }
}
action "Activate Configuration"
```

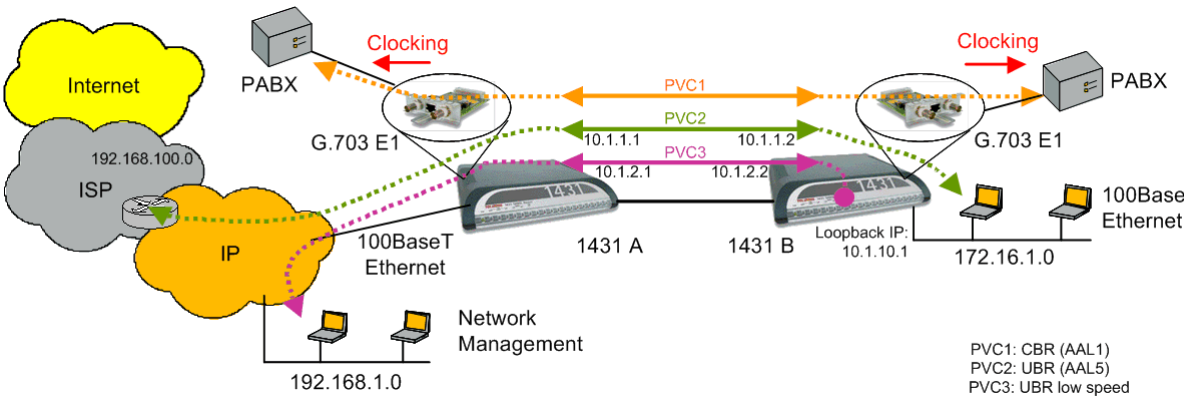
Telindus 1431 SHDSL CPE B

```
action "Load Default Configuration"
SET
{
    LIST
    {
      sysName = "1431_B"
    }
    SELECT lanInterface
    {
      LIST
      {
# the following sets the IP address of the LAN interface and sets the mode to routing
        ip =
        {
          address = 172.16.1.1
        }
        mode = "routing"
      }
    }
    SELECT wanInterface
    {
      SELECT atm
      {
        LIST
        {
# the following sets up the low speed management PVC
          lowSpeedPvc =
          {
            [a] =
            {
              name = "MgtPvc"
              ip =
              {
                address = 10.1.2.2
                netMask = 255.255.255.252
                remote = 10.1.2.1
              }
              atm =
              {
                vpi = 2
                vci = 100
              }
            }
          }
# the following sets up the CES PVC
          ces =
          {
            [a] =
            {
              name = "Ces4Pabx"
              atm =
              {
                vpi = 1
                vci = 100
              }
              intfName = "g703_1"
            }
          }
        }
      }
      SELECT line
      {
        LIST
        {
# the SHDSL line channel is set to remote by default
# the channel of the central 1431 should be set to central
# the extra Z-bit is enabled by default (maxNrOfZBits = 1)
# the following explicitly sets the line speed to the maximum speed
          minSpeed = "2304kbps"
# (the default value of the maxSpeed attribute is 2304kbps)
        }
      }
    }
    SELECT g703
    {
```

```
      LIST
      {
# the following sets the clock of the G703 interface to slaveOnNetwork
# the connected application should also slave on this clock
        clocking = "slaveOnNetwork"
# the framing mode is set to unframed mode by default
      }
      SELECT channel["g703_1"]
      {
        LIST
        {
# the following sets the encapsulation on the G.703 interface to CES
          encapsulation = "ces"
        }
      }
    }
    SELECT router
    {
      LIST
      {
# the following defines a route to the IP network connected to the
# LAN interface of the central 1431 and this for the management data
        routingTable =
        {
          [a] =
          {
            network = 192.168.1.0
            interface = "MgtPvc"
          }
        }
      }
    }
    SELECT management
    {
# the following defines a loopback IP address for management purposes
      SELECT loopback
      {
        LIST
        {
          ipAddress = 10.1.10.1
        }
      }
    }
}
action "Activate Configuration"
```

13.3.2 Combined framed CES E1 and IP services in a point-to-point set-up

Set-up



Set-up description

The drawing shows a point-to-point set-up where a CES connection is combined with an IP connection:

- The CES connection carries the data from the central PABX to the remote PABX. Suppose that for the CES link a complete *framed* E1 data stream has to be transmitted over a single pair SHDSL line.
- One IP connection carries internet data from the remote network connected to the LAN interface of Telindus 1431 SHDSL CPE B to the Internet.
- The other IP connection carries management data from the central management station to the remote Telindus 1431 SHDSL CPE (Telindus 1431 SHDSL CPE B).

The other major issues of this set-up are:

Issue	Description
bandwidth	The normal available bandwidth on a single standard SHDSL line is 2304 kbps. By using an additional Z-bit in the SHDSL framing, this bandwidth can be extended to 2312 kbps. In case framed E1 data has to be transmitted, timeslot 0 of the G.704 framing is used for synchronisation and does not contain user data. Therefore, the Telindus 1431 SHDSL CPE only has to transmit 1984 kbps of data together with a small amount of synchronisation. When taking the ATM, AAL and frame-synchronisation overhead into account, then the required bandwidth on the SHDSL line is: 1984 * (53 * 8) / (47 * 8 - 1) = 2243 kbps This means that there is still enough bandwidth available for the low speed management PVC and an additional standard PVC of 64 kbps of data (the PVC to the Internet): • the standard PVC: 2243 + 64 = 2307 kbps < 2312 kbps • the low speed management PVC: 2243 + 64 + 2.2 = 2309 kbps < 2312 kbps
clocking	In case of CES in a point-to-point set-up, one of the Telindus 1431 SHDSL CPEs should be configured as “central” (creating the master clock for the ATM cells) and the other as “remote” (slaving on the master clock from the “central” unit). In order not to have clock-slips, both applications connected to the leased line interface should be configured to slave on the clock provided by the Telindus 1431 SHDSL CPE.

Issue	Description
signalling support	In case of a point-to-point set-up, it is possible to transport any type of signalling transparently in timeslot 16. It suffices to enable timeslot 16 in the framed E1 data. This means that both CAS (Circuit Associated Signalling) and CCS (Common Circuit Signalling) are supported.

Configuration description

The configuration of the following devices is listed below:

- Telindus 1431 SHDSL CPE A on page 365
- Telindus 1431 SHDSL CPE B on page 368

Telindus 1431 SHDSL CPE A

```
action "Load Default Configuration"
SET
{
    LIST
    {
      sysName = "1431_A"
    }
    SELECT lanInterface
    {
      LIST
      {
# the following sets the IP address of the LAN interface and sets the mode to routing
        ip =
        {
          address = 192.168.1.1
        }
        mode = "routing"
      }
    }
    SELECT wanInterface
    {
      SELECT atm
      {
        LIST
        {
# the following sets up the internet data PVC
          pvcTable =
          {
            [a] =
            {
              name = "IspPvc"
              ip =
              {
                address = 10.1.1.1
                netMask = 255.255.255.252
                remote = 10.1.1.2
              }
              atm =
              {
                vpi = 1
                vci = 33
# the QoS is set to UBR by default
                peakCellRate = 64000
              }
            }
          }
# the following sets up the low speed management PVC
          lowSpeedPvc =
          {
            [a] =
            {
              name = "MgtPvc"
              ip =
              {
                address = 10.1.2.1
                netMask = 255.255.255.252
                remote = 10.1.2.2
```

```
              }
              atm =
              {
                vpi = 2
                vci = 100
              }
            }
          }
# the following sets up the CES PVC
          ces =
          {
            [a] =
            {
              name = "Ces4Pabx"
              atm =
              {
                vpi = 1
                vci = 100
              }
              intfName = "g703_1"
            }
          }
        }
        SELECT line
        {
          LIST
          {
# the following sets the SHDSL line channel to central
# the channel of the remote 1431 should be set to remote
            channel = central
# the extra Z-bit is enabled by default (maxNrOfZBits = 1)
# the following explicitly sets the line speed to the maximum speed
            minSpeed = "2304kbps"
# (the default value of the maxSpeed attribute is 2304kbps)
          }
        }
      }
      SELECT g703
      {
        LIST
        {
# the clocking mode is set to internal clocking by default
# the connected application and the remote 1431 should slave on this clock
# the following sets the framing mode to framed
          framing = "framed"
        }
        SELECT channel["g703_1"]
        {
          LIST
          {
# the following sets the encapsulation on the G.703 interface to CES
            encapsulation = "ces"
# the following enables timeslots 1 up to 31 (full framed E1)
            timeSlots =
            {
              ts1 = on
              ts2 = on
              ts3 = on
              ts4 = on
              ts5 = on
              ts6 = on
              ts7 = on
              ts8 = on
              ts9 = on
              ts10 = on
              ts11 = on
              ts12 = on
              ts13 = on
              ts14 = on
              ts15 = on
              ts16 = on
              ts17 = on
              ts18 = on
              ts19 = on
              ts20 = on
              ts21 = on
              ts22 = on
```

```
            ts23 = on
            ts24 = on
            ts25 = on
            ts26 = on
            ts27 = on
            ts28 = on
            ts29 = on
            ts30 = on
            ts31 = on
          }
        }
      }
    }
    SELECT router
    {
      LIST
      {
        routingTable =
        {
# the following defines a route to the remote network connected to the
# LAN interface of the remote 1431
          [a] =
          {
            network = 172.16.1.0
            interface = "IpPvc"
          }
# the following defines a route to the ISP network
          [a] =
          {
            network = 192.168.100.0
            interface = "lan"
          }
# the following defines a route to the remote 1431 for management purposes
          [a] =
          {
            network = 10.1.10.0
            mask = 255.255.255.255
            interface = "MgtPvc"
          }
        }
      }
    }
}
action "Activate Configuration"
```

Telindus 1431 SHDSL CPE B

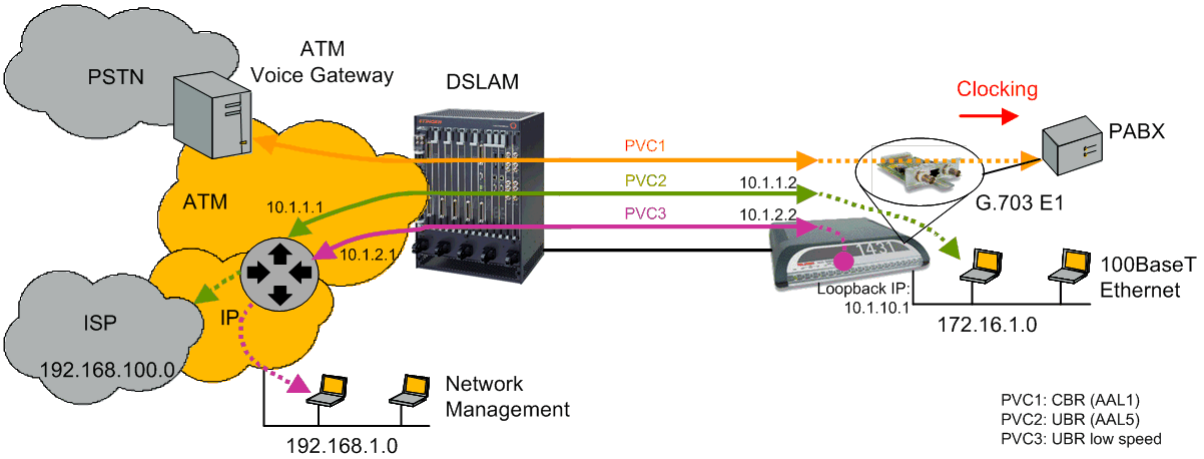
```
action "Load Default Configuration"
SET
{
    LIST
    {
      sysName = "1431_B"
    }
    SELECT lanInterface
    {
      LIST
      {
# the following sets the IP address of the LAN interface and sets the mode to routing
        ip =
        {
          address = 172.16.1.1
        }
        mode = "routing"
      }
    }
    SELECT wanInterface
    {
      SELECT atm
      {
        LIST
        {
# the following sets up the internet data PVC
          pvcTable =
          {
            [a] =
            {
              name = "IspPvc"
              ip =
              {
                address = 10.1.1.2
                netMask = 255.255.255.252
                remote = 10.1.1.1
              }
              atm =
              {
                vpi = 1
                vci = 33
# the QoS is set to UBR by default
                peakCellRate = 64000
              }
            }
          }
# the following sets up the low speed management PVC
          lowSpeedPvc =
          {
            [a] =
            {
              name = "MgtPvc"
              ip =
              {
                address = 10.1.2.2
                netMask = 255.255.255.252
                remote = 10.1.2.1
              }
              atm =
              {
                vpi = 2
                vci = 100
              }
            }
          }
# the following sets up the CES PVC
          ces =
          {
            [a] =
            {
              name = "Ces4Pabx"
              atm =
              {
                vpi = 1
                vci = 100
```

```
              }
              intfName = "g703_1"
            }
          }
        }
      }
      SELECT line
      {
        LIST
        {
# the SHDSL line channel is set to remote by default
# the channel of the central 1431 should be set to central
# the extra Z-bit is enabled by default (maxNrOfZBits = 1)
# the following explicitly sets the line speed to the maximum speed
          minSpeed = "2304kbps"
# (the default value of the maxSpeed attribute is 2304kbps)
        }
      }
    }
    SELECT g703
    {
      LIST
      {
# the following sets the clock of the G703 interface to slaveOnNetwork
# the connected application should also slave on this clock
        clocking = "slaveOnNetwork"
# the following sets the framing mode to framed
        framing = "framed"
      }
      SELECT channel["g703_1"]
      {
        LIST
        {
# the following sets the encapsulation on the G.703 interface to CES
          encapsulation = "ces"
# the following enables timeslots 1 up to 31 (full framed E1)
          timeSlots =
          {
            ts1 = on
            ts2 = on
            ts3 = on
            ts4 = on
            ts5 = on
            ts6 = on
            ts7 = on
            ts8 = on
            ts9 = on
            ts10 = on
            ts11 = on
            ts12 = on
            ts13 = on
            ts14 = on
            ts15 = on
            ts16 = on
            ts17 = on
            ts18 = on
            ts19 = on
            ts20 = on
            ts21 = on
            ts22 = on
            ts23 = on
            ts24 = on
            ts25 = on
            ts26 = on
            ts27 = on
            ts28 = on
            ts29 = on
            ts30 = on
            ts31 = on
          }
        }
      }
    }
    SELECT router
    {
      LIST
      {
        routingTable =
```

```
        {
# the following defines a route to the ISP network
          [a] =
          {
            network = 192.168.100.0
            interface = "IspPvc"
          }
# the following defines a route to the IP network connected to the
# LAN interface of the central 1431 and this for the management data
          [a] =
          {
            network = 192.168.1.0
            interface = "MgtPvc"
          }
        }
      }
    }
    SELECT management
    {
# the following defines a loopback IP address for management purposes
      SELECT loopback
      {
        LIST
        {
          ipAddress = 10.1.10.1
        }
      }
    }
}
action "Activate Configuration"
```

13.3.3 Combined framed CES E1 and IP services in a DSLAM set-up

Set-up



Set-up description

The drawing shows a DSLAM set-up where a CES connection is combined with an IP connection:

- The CES connection carries the data from the ATM voice gateway to the remote PABX. Suppose that for the CES link a complete *framed* E1 data stream has to be transmitted over a single pair SHDSL line.
- One IP connection carries internet data from the remote network connected to the LAN interface of the Telindus 1431 SHDSL CPE to the Internet.
- The other IP connection carries management data from the central management station to the Telindus 1431 SHDSL CPE.

The other major issues of this set-up are:

Issue	Description
bandwidth	The normal available bandwidth on a single standard SHDSL line is 2304 kbps. By using an additional Z-bit in the SHDSL framing, this bandwidth can be extended to 2312 kbps[1]. In case framed E1 data has to be transmitted, timeslot 0 of the G.704 framing is used for synchronisation and does not contain user data. Therefore, the Telindus 1431 SHDSL CPE only has to transmit 1984 kbps of data together with a small amount of synchronisation. When taking the ATM, AAL and frame-synchronisation overhead into account, then the required bandwidth on the SHDSL line is: 1984 * (53 * 8) / (47 * 8 - 1) = 2243 kbps This means that there is still enough bandwidth available for the low speed management PVC and an additional standard PVC of 64 kbps of data (the PVC to the Internet): • the standard PVC: 2243 + 64 = 2307 kbps < 2312 kbps • the low speed management PVC: 2243 + 64 + 2.2 = 2309 kbps < 2312 kbps
clocking	In case of CES in a DSLAM set-up, the Telindus 1431 SHDSL CPE has to be configured as “remote” (slaving on the master clock from the DSLAM). The application connected to the leased line interface should be configured to slave on the clock provided by the Telindus 1431 SHDSL CPE.

Issue	Description
signalling support	In case of a DSLAM set-up and interfacing with an ATM voice gateway, the Telindus 1431 SHDSL CPE should be configured for framed mode. Today CCS is supported in this way.

1. Note that strictly speaking it is not necessary to enabled the Z-bits, although you might have to reduce the bandwidth of the ATM PVC carrying the Internet data somewhat. If you do enable the Z-bits, then check whether the DSLAM supports this.

Configuration description

The configuration of the Telindus 1431 SHDSL CPE looks as follows:

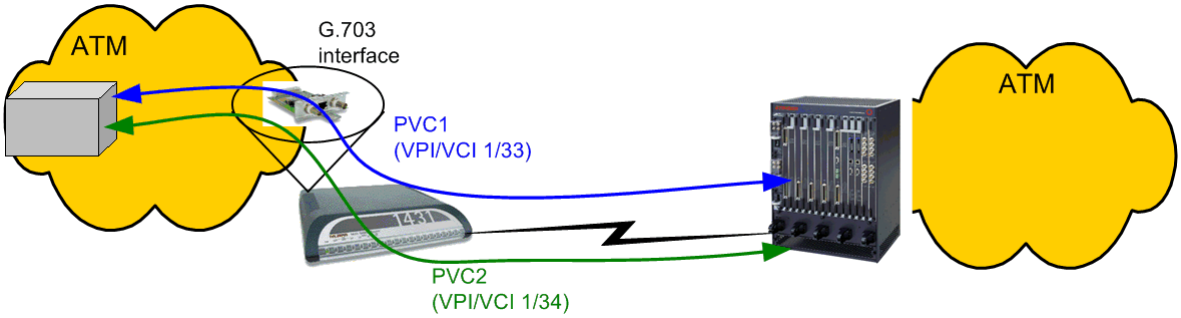
```
action "Load Default Configuration"
SET
{
    LIST
    {
      sysName = "1431"
    }
    SELECT lanInterface
    {
      LIST
      {
# the following sets the IP address of the LAN interface and sets the mode to routing
        ip =
        {
          address = 172.16.1.1
        }
        mode = "routing"
      }
    }
    SELECT wanInterface
    {
      SELECT atm
      {
        LIST
        {
# the following sets up the internet data PVC
          pvcTable =
          {
            [a] =
            {
              name = "IspPvc"
              ip =
              {
                address = 10.1.1.2
                netMask = 255.255.255.252
                remote = 10.1.1.1
              }
              atm =
              {
                vpi = 1
                vci = 33
# the QoS is set to UBR by default
                peakCellRate = 64000
              }
            }
          }
# the following sets up the low speed management PVC
          lowSpeedPvc =
          {
            [a] =
            {
              name = "MgtPvc"
              ip =
              {
                address = 10.1.2.2
                netMask = 255.255.255.252
                remote = 10.1.2.1
              }
              atm =
              {
```

```
                vpi = 2
                vci = 100
              }
            }
          }
# the following sets up the CES PVC
          ces =
          {
            [a] =
            {
              name = "Ces4Pabx"
              atm =
              {
                vpi = 1
                vci = 100
              }
              intfName = "g703_1"
            }
          }
        }
      }
      SELECT line
      {
        LIST
        {
# the SHDSL line channel is set to remote by default
# the extra Z-bit is enabled by default (maxNrOfZBits = 1)
# check whether the DSLAM supports this feature
# the minimum and maximum line speed are set to their default values
# this means the line speed is in “auto” mode (it will follow the line speed
# imposed by the DSLAM)
        }
      }
    }
    SELECT g703
    {
      LIST
      {
# the following sets the clock of the G703 interface to slaveOnNetwork
# the connected application should also slave on this clock
        clocking = "slaveOnNetwork"
# the following sets the framing mode to framed
        framing = "framed"
      }
      SELECT channel["g703_1"]
      {
        LIST
        {
# the following sets the encapsulation on the G.703 interface to CES
          encapsulation = "ces"
# the following enables timeslots 1 up to 31 (full framed E1)
          timeSlots =
          {
            ts1 = on
            ts2 = on
            ts3 = on
            ts4 = on
            ts5 = on
            ts6 = on
            ts7 = on
            ts8 = on
            ts9 = on
            ts10 = on
            ts11 = on
            ts12 = on
            ts13 = on
            ts14 = on
            ts15 = on
            ts16 = on
            ts17 = on
            ts18 = on
            ts19 = on
            ts20 = on
            ts21 = on
            ts22 = on
            ts23 = on
            ts24 = on
            ts25 = on
```

```
            ts26 = on
            ts27 = on
            ts28 = on
            ts29 = on
            ts30 = on
            ts31 = on
          }
        }
      }
    }
    SELECT router
    {
      LIST
      {
        routingTable =
        {
# the following defines a route to the ISP network
          [a] =
          {
            network = 192.168.100.0
            interface = "IspPvc"
          }
# the following defines a route to the management network
          [a] =
          {
            network = 192.168.1.0
            interface = "MgtPvc"
          }
        }
      }
    }
    SELECT management
    {
# the following defines a loopback IP address for management purposes
      SELECT loopback
      {
        LIST
        {
          ipAddress = 10.1.10.1
        }
      }
    }
}
action "Activate Configuration"
```

13.4 Setting up ATM over E1

Set-up



Set-up description

ATM PVCs can be switched transparently from the G.703 interface to the SHDSL line. This makes the Telindus 1431 SHDSL CPE ideal for migration purposes (e.g. in a mobile network application: migration from UMTS phase 1 (ATM) to UMTS phase 2 (IP)).

Configuration description

The configuration of the Telindus 1431 SHDSL CPE looks as follows:

```
action "Load Default Configuration"
SET
{
    LIST
    {
      sysName = "1431"
    }
    SELECT wanInterface
    {
      SELECT atm
      {
        LIST
        {
# the following sets up the 2 switching ATM PVCs
          atmSwitching =
          {
            [a] =
            {
              name = "pvc1"
              atm =
              {
                vpi = 1
                vci = 33
              }
            }
            [a] =
            {
              name = "pvc2"
              atm =
              {
                vpi = 1
                vci = 34
              }
            }
          }
        }
      }
    }
    SELECT g703
    {
      LIST
      {
# since this is a DSLAM setup, the 1431 is configured for slaving to the DSLAM
# for clocking and line (speed) parameters
        clocking = "slaveOnNetwork"
```

```
        }
        SELECT channel["g703_1"]
        {
          LIST
          {
# the following sets the encapsulation of the G.703 interface to ATM
            encapsulation = "atm"
          }
        }
    }
}
action "Activate Configuration"
```

Reference manual

14 Configuration attributes

This chapter discusses the configuration attributes of the Telindus 1431 SHDSL CPE. The following gives an overview of this chapter:

- 14.1 - Configuration attribute overview on page 380
- 14.2 - General configuration attributes on page 386
- 14.3 - LAN interface configuration attributes on page 392
- 14.4 - WAN interface configuration attributes on page 401
- 14.5 - Encapsulation configuration attributes on page 404
- 14.6 - SHDSL line configuration attributes on page 443
- 14.7 - End configuration attributes on page 453
- 14.8 - Modular user interface configuration attributes on page 455
- 14.9 - Router configuration attributes on page 468
- 14.10 - Bridge configuration attributes on page 536
- 14.11 - SNMP configuration attributes on page 553
- 14.12 - Management configuration attributes on page 555

14.1 Configuration attribute overview

Refer to 4.3 - The objects in the Telindus 1431 SHDSL CPE containment tree on page 46 to find out which objects are present by default, which ones you can add yourself and which ones are added automatically.

> telindus1431Router
- sysName
- sysContact
- sysLocation
- bootFromFlash
- security
- alarmMask
- alarmLevel
- Action: Activate Configuration
- Action: Load Default Configuration
- Action: Load Preconfiguration
- Action: Load Saved Configuration
- Action: Cold Boot

>> lanInterface
- name
- mode
- ip
- bridging
- priorityPolicy
- arp
- adapter
- vlan
- alarmMask
- alarmLevel

>> wanInterface
- name
- encapsulation
- priorityPolicy
- maxFifoQLen
- alarmMask
- alarmLevel

>>> atm
- pvcTable
- vp
- lowSpeedPvc
- frAtm
- ces
- atmSwitching

>>> line
- channel
- region
- retrain
- startupMargin
- minSpeed
- maxSpeed
- minSpeed2P[1]
- maxSpeed2P[1]
- mode[1]
- dualPairMode
- linkAlarmThresholds
- eocHandling
- management
- maxNrOfZBits
- testDuration
- alarmMask
- alarmLevel

>>>> linePair[ ]
- alarmMask
- alarmLevel

>>> end

>>>> linePair[ ]
- alarmMask
- alarmLevel

>> g703
- name
- coding
- framing
- clocking
- crc4Insertion
- aisDetection
- sqTime
- sqThreshold
- jitterAttenuation
- testDuration
- alarmMask
- alarmLevel

1. Only present in case of a 2 pair version.

>>> channel[g703_1]
timeSlots
encapsulation
maxFifoQLen
alarmMask
alarmLevel

>>>> atm
atm

>>>> frameRelay
lmi

>>>> ces
maxCellVariation
fillSize
sdtMethod
dataBitsReversed

>>> transpChannel[ ]
<Contains the same attributes as the channel[g703_1] object. It also contains the ces sub-object. It does not contain the frameRelay or atm sub-object.>

>> <serialIf>
name
encapsulation
maxFifoQLen
transmitSampleClock
receiveSampleClock
testDuration
alarmMask
alarmLevel

>>> atm
atm

>>> frameRelay
lmi
syncSettings

>>> ces
maxCellVariation
fillSize
dataBitsReversed
syncSettings

>> router

- defaultRoute
- routingTable
- routingProtocol
- alternativeRoutes
- ripUpdateInterval
- ripHoldDownTime
- ripv2SecretTable
- sysSecret
- pppSecretTable
- helperProtocols
- sendTtlExceeded
- sendPortUnreachable
- sendAdminUnreachable
- dhcpStatic
- dhcpDynamic
- dhcpCheckAddress
- radius
- dns
- alarmMask
- alarmLevel

>>> defaultNat

- patAddress
- portTranslations
- servicesAvailable
- addresses
- gateway
- tcpSocketTimeOut
- udpSocketTimeOut
- tcpSockets
- udpSockets
- dmzHost

>>> nat[ ]

<Contains the same objects as the defaultNat object.>

>>> tunnels

- l2tpTunnels
- ipsecL2tpTunnels

>>> manualSA[ ]

- espEncryptionAlgorithm
- espEncryptionKey
- espAuthenticationAlgorithm
- espAuthenticationKey
- spi

>>> routingFilter[ ]
filter

>>> trafficPolicy[ ]
method
trafficShaping
tos2QueueMapping
dropLevels

>>> priorityPolicy[ ]
algorithm
countingPolicy
queueConfigurations
lowdelayQuotum
bandwidth

>>> ospf
routerId
refBandwidth
keyChains

>>>> area
areaId
stub
networks
virtualLinks
ranges

>> bridge

>>> bridgeGroup
name
ip
arp
bridgeCache
bridgeTimeOut
spanningTree
localAccess
macAddress
vlan
vlanSwitching

>>> vpnBridgeGroup[ ]
- ip
- arp
- bridgeCache
- bridgeTimeOut
- spanningTree
- localAccess
- macAddress
- vlan
- vlanSwitching

>>> accessList[ ]
- macAddress

>>> trafficPolicy[ ]
- vlanPriorityMap
- dropLevels

>> snmp
- trapDestinations
- mib2Traps

>> management
- cms2Address
- accessList
- snmp
- telnet
- tftp
- ftp
- accessPolicy
- consoleNoTrafficTimeOut
- alarmFilter
- atwinGraphics
- timedStatsAvailability
- timeServer
- timeZone
- sysLog
- loginControl
- ctrlPortProtocol

>>> loopback
- ipAddress
- ipNetMask

14.2 General configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/sysName on page 387
- telindus1431Router/sysContact on page 387
- telindus1431Router/sysLocation on page 387
- telindus1431Router/bootFromFlash on page 387
- telindus1431Router/security on page 388
- telindus1431Router/<alarmConfigurationAttributes> on page 389

This section describes the following actions:

- telindus1431Router/Activate Configuration on page 390
- telindus1431Router/Load Default Configuration on page 390
- telindus1431Router/Load Preconfiguration on page 390
- telindus1431Router/Load Saved Configuration on page 391
- telindus1431Router/Cold Boot on page 391

telindus1431Router/sysName

Default:<empty>
Range: 0 ... 64 characters

Use this attribute to assign a name to the Telindus 1431 SHDSL CPE. The sysName attribute is an SNMP MIB2 parameter.

This attribute is also used in the PPP authentication process. The PPP authenticator uses the sysName attribute in order to verify the peer its response.

For more information on PPP authentication, refer to …

- 9.4.6 - Configuring PAP on page 176
- 9.4.8 - Configuring CHAP on page 179

telindus1431Router/sysContact

Default:<empty>
Range: 0 ... 64 characters

Use this attribute to add contact information. You could, for instance, enter the name and telephone number of the person to contact in case problem occur.

The sysContact attribute is an SNMP MIB2 parameter.

telindus1431Router/sysLocation

Default:<empty>
Range: 0 ... 64 characters

Use this attribute to specify the physical location of the Telindus 1431 SHDSL CPE. The sysLocation attribute is an SNMP MIB2 parameter.

telindus1431Router/bootFromFlash

Default:auto
Range: enumerated, see below

Part of the flash memory of the Telindus 1431 SHDSL CPE is organised as a file system. In this file system, you can store two complete application software versions. You can use the bootFromFlash attribute to switch between these softwares.

When you store two application software versions in the file system, they are automatically renamed as CONTROL1 and CONTROL2, respectively. You can check this with the status attribute telindus1431Router/fileSystem/fileList.

The bootFromFlash attribute has the following values:

Value	When the Telindus 1431 SHDSL CPE boots …
flash1	the application software CONTROL1 is active.
flash2	the application software CONTROL2 is active.
auto	the Telindus 1431 SHDSL CPE automatically chooses the most recent application software. It does this by comparing the application software version numbers.

telindus1431Router/security

Default:<empty>
Range: table, see below

Use this attribute to create a list of passwords with associated access levels in order to avoid unauthorised access to the Telindus 1431 SHDSL CPE and the network.

The security table contains the following elements:

Element	Description
password	Use this element to set the password. You can then associate this password with a certain access level. Default:<empty> Range: 0 … 20 characters Also see Important remarks on page 389.
accessRights	Use this element to set the access level associated with the password. It is a bit string of which each bit corresponds to an access level. The different access levels are listed below. Default:1111 Range: bit string, see below

The following table shows, for each access level, what you can or can not do:

Access level	Read attributes	Change attributes	Read security attributes[1]	Change security attributes	Execute actions[2]	Access file system
readAccess	yes	no	no	no	no	no
writeAccess	yes	yes	no	no	yes	no
securityAccess	no	no	yes	yes	no	no
fileSystem-Access	no	no	no	no	no	yes

1. The Telindus 1431 SHDSL CPE has the following security attributes:
   telindus1431Router/sysName
   telindus1431Router/security
   telindus1431Router/router/sysSecret, pppSecretTable and ripv2SecretTable
   telindus1431Router/router/priorityPolicy and trafficPolicy
   telindus1431Router/wanInterface/ppp/authentication and authenPeriod
   telindus1431Router/management/accessList, snmp, telnet and tftp
2. Actions are e.g. Cold Boot, clearArpCache, clearBridgeCache, etc…

Important remarks

- If you create no passwords, everybody has complete access.
- If you define at least one password, it is impossible to access the Telindus 1431 SHDSL CPE with one of the management systems without entering the correct password.
- If you create a list of passwords, create at least one with write and security access. If not, you will be unable to make configuration and password changes after activation of the new configuration.
- If you access the Telindus 1431 SHDSL CPE via RADIUS, then this requires that the password is associated with a user. So in that case, enter the username and password in the password element as follows:
  `"username:password"`.
  - Note that if the ‘:’ is omitted, then the string is considered to be a password.
  - Note that if you do not access the device via RADIUS, but you access it directly with e.g. TMA, then you have to enter the *complete* string, i.e. `"username:password"`. Not just the `password` part of the string.

telindus1431Router/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the telindus1431Router object, refer to 17.3 - General alarms on page 759.

telindus1431Router/Activate Configuration

If you execute this action, then the editable non-active configuration becomes the active configuration. Refer to 5.8.1 - What are the different configuration types? on page 86 for more information.

When use this action?

If you configure the Telindus 1431 SHDSL CPE using …

- any other maintenance tool than the graphical user interface based TMA (e.g. ATWIN, CLI, Web Interface, EasyConnect terminal, TMA CLI), then execute the Activate Configuration action to activate the configuration after you finished configuring the Telindus 1431 SHDSL CPE or after you executed the Load Saved Configuration or Load Default Configuration action.
- TMA, then do not just execute the Activate Configuration action to activate the configuration after you finished configuring the Telindus 1431 SHDSL CPE, but use the TMA button *Send all attributes to device* instead. You can, however, execute the Activate Configuration action after you executed the Load Saved Configuration or Load Default Configuration action.

telindus1431Router/Load Default Configuration

If you execute this action, then the non-active configuration is overwritten by the default configuration. Refer to 5.8.1 - What are the different configuration types? on page 86 for more information.

When use this action?

If you install the Telindus 1431 SHDSL CPE for the first time, all configuration attributes have their default values. If the Telindus 1431 SHDSL CPE has already been configured but you want to start from scratch, then use this action to revert to the default configuration.

telindus1431Router/Load Preconfiguration

If you execute this action, then the non-active configuration is overwritten by the preconfiguration (if present, else this action does nothing). Refer to 5.8.1 - What are the different configuration types? on page 86 for more information.

When use this action?

If you install the Telindus 1431 SHDSL CPE for the first time and if a preconfiguration is present (i.e. a *precfg.cms* file is present on the file system), then some configuration attributes will be set to a preconfigured value. The rest of the attributes will be set to their default values. If the Telindus 1431 SHDSL CPE has already been configured but you want to revert to the preconfiguration, then use this action.

telindus1431Router/Load Saved Configuration

If you execute this action, then the non-active configuration is overwritten by the active configuration currently used by the Telindus 1431 SHDSL CPE. Refer to 5.8.1 - What are the different configuration types? on page 86 for more information.

When use this action?

If you are in the progress of modifying the non-active configuration but made some mistakes, then use this action to revert to the active configuration.

telindus1431Router/Cold Boot

If you execute this action, then the Telindus 1431 SHDSL CPE reboots. As a result, the Telindus 1431 SHDSL CPE …

- performs a self-test.
- checks the software.
- reads the saved configuration and restarts program execution.

When use this action?

Use this action, for instance, to activate new application software.

14.3 LAN interface configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/lanInterface/name on page 393
- telindus1431Router/lanInterface/mode on page 393
- telindus1431Router/lanInterface/ip on page 393
- telindus1431Router/lanInterface/bridging on page 393
- telindus1431Router/lanInterface/priorityPolicy on page 394
- telindus1431Router/lanInterface/arp on page 394
- telindus1431Router/lanInterface/adapter on page 395
- telindus1431Router/lanInterface/vlan on page 396
- telindus1431Router/lanInterface/<alarmConfigurationAttributes> on page 400

telindus1431Router/lanInterface/name

Default:lan
Range: 1 ... 24 characters

Use this attribute to assign an administrative name to the LAN interface.

telindus1431Router/lanInterface/mode

Default:bridging
Range: enumerated, see below

Use this attribute to determine whether the packets are treated by the routing process, the bridging process or both.

The mode attribute has the following values:

Value	Description
bridging	All packets are bridged. The settings of the IP configuration attributes of the LAN are ignored. If you want to manage the Telindus 1431 SHDSL CPE via IP, you have to configure an IP address in the bridgeGroup object. Refer to telindus1431Router/bridge/bridgeGroup/ip on page 538.
routing	The IP packets are routed. All other protocols are discarded.
routingAndBridging	IP packets are routed. Non-IP packets are bridged. The settings of the IP configuration attributes are taken into account.

telindus1431Router/lanInterface/ip

Default:-
Range: structure, see below

Use this attribute to configure the IP related parameters of the LAN interface.

Refer to …

- 5.2 - Configuring IP addresses on page 57 for general information on configuring IP addresses.
- 5.2.3 - Explaining the ip structure on page 60 for a detailed description of the ip structure.

Important remark

If you set the configuration attribute telindus1431Router/lanInterface/mode to bridging, then the settings of the configuration attribute telindus1431Router/lanInterface/ip are ignored. As a result, if you want to manage the Telindus 1431 SHDSL CPE via IP, you have to configure an IP address in the bridgeGroup object instead: telindus1431Router/bridge/bridgeGroup/ip.

telindus1431Router/lanInterface/bridging

Default:-
Range: structure, see below

Use this attribute to configure the bridging related parameters of the LAN interface.

Refer to …

- 11 - Configuring bridging on page 261 for more information on bridging.
- 11.2.6 - Explaining the bridging structure on page 279 for a detailed description of the bridging structure.

telindus1431Router/lanInterface/priorityPolicy

Default:<empty>
Range: 0 ... 24 characters

Use this attribute to apply a priority policy on the LAN interface.

Do this by entering the index name of the priority policy you want to use. You can create the priority policy itself by adding a priorityPolicy object and by configuring the attributes in this object.

Example

If you created a priorityPolicy object with index name my_priority_policy (i.e. priorityPolicy[my_priority_policy]) and you want to apply this priority policy here, then enter the index name as value for the priorityPolicy attribute.

Refer to 10.8.6 - Creating a priority policy on page 248 for more information on priority policies.

telindus1431Router/lanInterface/arp

Default:-
Range: structure, see below

Use this attribute to configure the Address Resolution Protocol (ARP) cache.

The arp structure contains the following elements:

Element	Description
timeOut	Use this element to set the ageing time of the ARP cache entries. Refer to The ARP cache time-out. Default:00000d 02h 00m 00s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s
proxyArp	Use this element to enable or disable the proxy ARP mechanism. Refer to What is proxy ARP?. Default:enabled Range: enabled / disabled Note that when you want to access a proxied device via its IP address that is configured in the telindus1431Router/proxy/nmsGroup/objectTable, then the proxyArp element must be set to enabled.

What is the ARP cache?

The LAN interface has been allocated a fixed Ethernet address, also called MAC (Medium Access Control) address. This MAC address is not user configurable. The IP address of the LAN interface, on the other hand, is user configurable. This means that the user associates an IP address with the predefined MAC address. The MAC address - IP address pairs are kept in a table, called the ARP cache. Refer to telindus1431Router/lanInterface/arpCache on page 581 for an example of such a table.

How does the ARP cache work?

Before the Telindus 1431 SHDSL CPE sends an IP packet on the LAN interface, it has to know the MAC address of the destination device. If the address is not present in the ARP cache table yet, the Telindus 1431 SHDSL CPE sends an ARP request on the Ethernet to learn the MAC address and associated IP address of the destination device. This address pair is then written in the ARP cache. Once the address pair is present, the Telindus 1431 SHDSL CPE can reference to this pair if it has to send an IP packet to the same device later on.

The ARP cache time-out

Summarised, all the MAC address - IP address pairs from ARP requests and replies received on the LAN interface are kept in the ARP cache. However, if devices on the network are reconfigured then this MAC address - IP address relation may change. Therefore, the ARP cache entries are automatically removed from the cache after a fixed time-out. This time-out period can be set with the timeOut element.

What is proxy ARP?

Proxy ARP is the technique in which one host, usually a router, answers ARP requests intended for another machine. By "faking" its identity, the router accepts responsibility for routing packets to the "real" destination. Proxy ARP can help machines on a subnet reach remote subnets without configuring routing or a default gateway.

The advantages and disadvantages of proxy ARP are listed below:

advantages	The main advantage of using proxy ARP is that it can be added to a single router on a network without disturbing the routing tables of the other routers on the network. Proxy ARP should be used on the network where IP hosts are not configured with default gateway or does not have any routing intelligence.
disadvantages	Hosts have no idea of the physical details of their network and assume it to be a flat network in which they can reach any destination simply by sending an ARP request. But using ARP for everything has disadvantages, some of which are listed below: • It increases the amount of ARP traffic on your segment. • Hosts need larger ARP tables to handle IP-to-MAC address mappings. • Security may be undermined. A machine can claim to be another in order to intercept packets, an act called "spoofing." • It does not work for networks that do not use ARP for address resolution. • It does not generalise to all network topologies (for example, more than one router connecting two physical networks).

telindus1431Router/lanInterface/adapter

Default:autoDetect
Range: enumerated, see below

Use this attribute to set the Ethernet mode of the LAN interface.

The adapter attribute has the following values: autoDetect, 10Mb/halfDuplex, 10Mb/fullDuplex, 100Mb/halfDuplex, 100Mb/fullDuplex.

telindus1431Router/lanInterface/vlan

Default:<empty>
Range: table, see below

Use this attribute to create and configure VLANs. Refer to 12.3 - Configuring VLANs on page 306 for an introduction and a step-by-step procedure.

As long as no VLANs are created in the vlan table, the LAN interface accepts both VLAN untagged and VLAN tagged frames. The VLAN *untagged* frames are bridged and/or routed (depending on the setting of the mode attribute). The VLAN *tagged* frames are bridged (in case the mode attribute is set to bridging or bridgingAndRouting, else they are discarded).

As soon as a VLAN is created in the vlan table, the LAN interface still accepts VLAN untagged frames but only accepts those VLAN tagged frames of which the VLAN ID corresponds with the VLAN ID that has been configured in the vlan table (refer to the configuration element vid on page 397). Other VLAN tagged frames are discarded.

The vlan table contains the following elements:

Element	Description
name	Use this element to assign an administrative name to the VLAN. Default:<empty> Range: 0 ... 24 characters
adminStatus	Use this element to activate (up) or deactivate (down) the VLAN. Default:up Range: up / down
mode	Use this element to determine whether, for the corresponding VLAN, the packets are treated by the routing process or the bridging process. Default:bridging Range: enumerated, see below The mode element has the following values: • bridging. All packets received on the VLAN are bridged. • routing. All packets received on the VLAN are routed.
ip	Use this element to configure the IP related parameters of the VLAN. Default:- Range: structure, see below Refer to … • 5.2 - Configuring IP addresses on page 57 for general information on configuring IP addresses. • 5.2.3 - Explaining the ip structure on page 60 for a detailed description of the ip structure.
bridging	Use this element to configure the bridging related parameters of the VLAN. Default:- Range: structure, see below Refer to … • 11 - Configuring bridging on page 261 for more information on bridging. • 11.2.6 - Explaining the bridging structure on page 279 for a detailed description of the bridging structure.
vlan	Use this element to configure the specific VLAN parameters. Default:- Range: structure, see below Refer to telindus1431Router/lanInterface/vlan/vlan on page 397 for a detailed description of the vlan structure.

telindus1431Router/lanInterface/vlan/vlan

Default:-
Range: structure, see below

Use the vlan structure in the vlan table to configure the VLAN related parameters of the corresponding VLAN.

Refer to 12.3 - Configuring VLANs on page 306 for an introduction on VLANs.

The vlan structure contains the following elements:

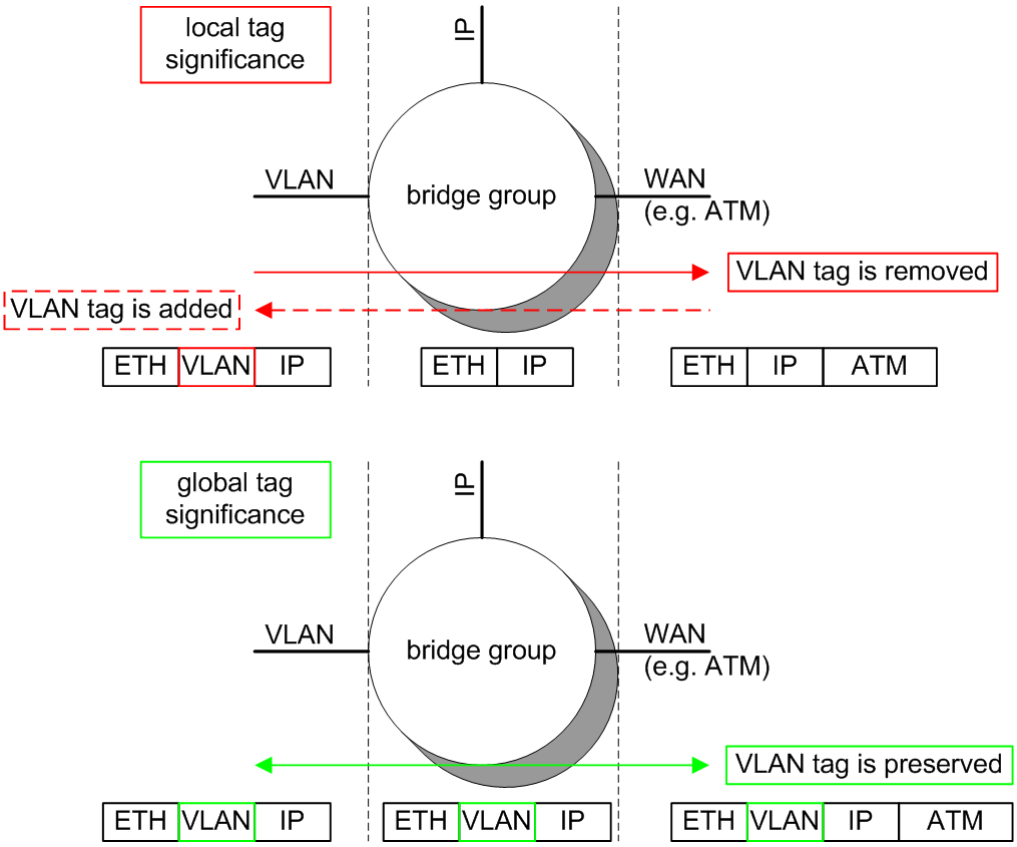
Element	Description
vid	Use this element to set the VLAN ID. Default:1 Range: 0 ... 4095 **Important remark** You can also enter VLAN tag 0 as VLAN ID. This is not really a VLAN, but a way to reverse the filtering: - all the untagged data is passed, internally, to VLAN 0. - all the other, tagged, data for which no VLANs are defined, are handled by the main LAN interface. This allows a set-up where a number of VLANs are VLAN switched, while other VLANs and untagged data are bridged. This is particularly interesting for VLAN based networks with Ethernet switch discovery protocols like Cisco CDP. Until now, this was not possible since the VLAN switching mode did not allow flooding packets over multiple interfaces (bridging), nor did it allow terminating management data in the device. In such set-up, the configuration looks as follows: - A first bridge group includes all VLANs that need to be switched. This bridge group is set in VLAN switching mode. - A second bridge group includes VLAN 0 and possibly also a VLAN for management of the device. - The interface VLAN table(s) include(s) entries for all switched VLANs, VLAN 0 and possibly a VLAN for management.

Element	Description
tagSignificance	This element is only relevant when you set the mode element to bridging. Default:global Range: local / global Use this element to determine whether the VLAN tag has a local or a global significance. The tagSignificance element has the following values: • local. The VLAN tag only has a local significance, i.e. it is only present on the LAN interface side. This means that when the data is moved … - from the LAN interface to the bridge group, the VLAN tag is removed. - from the bridge group to the LAN interface, the VLAN tag is added. Keep in mind that when the VLAN tag is removed, you not only discard the VLAN ID but also the user priority. When you perform bridging between VLANs, then set the tagSignificance element to local. Else you get multiple VLAN tags in the Ethernet frames. • global. The VLAN tag has a global significance, i.e. it is both present on the LAN interface and the bridge group side. This means that when the data is moved from the LAN interface to the bridge group or vice versa, the VLAN tag is always preserved. Refer to the figure Local or global VLAN tag significance on page 400.
txCos	Use this element to set the default user priority (802.1P, also called COS) of the transmitted VLAN frames. Default:0 Range: 0 ... 7
changeTos	Use this element to enable or disable the COS to TOS mapping. Default:disabled Range: enabled / disabled If you set the changeTos attribute to disabled, then the element cosTosMap is ignored. Note that the *TOS* to *COS* mapping is always enabled, irrespective with the setting of the changeTos attribute.
cosTosMap	Use this element to determine how the VLAN user priority (COS) maps onto the IP TOS byte value. Default:- Range: structure, see below Note that the COS to TOS mapping only occurs in case … • the mode element is set to routing and the changeTos element is set to enabled. or • the mode element is set to bridging, the changeTos element is set to enabled *and* the tagSignificance element is set to local. The cosTosMap structure contains the following elements: • p0 ... p7. Use these elements to define which VLAN user priority (0 up to 7) maps onto which IP TOS byte value (0 up to 255). Default:0 Range: 0 ... 7

Element	Description
tosCosMap	Use this element to determine how the IP TOS byte value maps onto the VLAN user priority (COS). Default:- Range: table, see below Note that the COS to TOS mapping only occurs in case … • the mode element is set to routing. or • the mode element is set to bridging *and* the tagSignificance element is set to local. The tosCosMap table contains the following elements: • startTos and endTos. Use these elements to set the TOS byte value range that has to be mapped. Default:0 Range: 0 ... 255 • cos. Use this element to set the VLAN user priority (COS) value on which the specified TOS byte value range has to be mapped. Default:0 Range: 0 ... 7

Local or global VLAN tag significance

The following figure shows how the tagSignificance element influences the VLAN tagging between the LAN interface and the bridge group:



telindus1431Router/lanInterface/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the lanInterface object, refer to 17.4 - LAN interface alarms on page 761.

14.4 WAN interface configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/wanInterface/name on page 402
- telindus1431Router/wanInterface/encapsulation on page 402
- telindus1431Router/wanInterface/priorityPolicy on page 402
- telindus1431Router/wanInterface/maxFifoQLen on page 402
- telindus1431Router/wanInterface/<alarmConfigurationAttributes> on page 402

telindus1431Router/wanInterface/name

Default:wan
Range: 1 ... 24 characters

Use this attribute to assign an administrative name to the WAN interface.

telindus1431Router/wanInterface/encapsulation

Default:atm
Range: enumerated, see below

Use this attribute to select the encapsulation protocol on the WAN interface.

The encapsulation attribute has the following values: atm (you can only choose ATM encapsulation on the WAN interface).

telindus1431Router/wanInterface/priorityPolicy

Default:<empty>
Range: 0 ... 24 characters

Use this attribute to apply a priority policy on the WAN interface.

Do this by entering the index name of the priority policy you want to use. You can create the priority policy itself by adding a priorityPolicy object and by configuring the attributes in this object.

Example

If you created a priorityPolicy object with index name my_priority_policy (i.e. priorityPolicy[my_priority_policy]) and you want to apply this priority policy here, then enter the index name as value for the priorityPolicy attribute.

Refer to 10.8.6 - Creating a priority policy on page 248 for more information on priority policies.

telindus1431Router/wanInterface/maxFifoQLen

Default:200
Range: 1 ... 4000

Use this attribute to set the maximum length (number of packets) of the First In First Out queue.

Refer to telindus1431Router/router/priorityPolicy[ ]/algorithm on page 528 for more information on this queue.

telindus1431Router/wanInterface/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the wanInterface object, refer to 17.5 - WAN interface alarms on page 762.

14.5 Encapsulation configuration attributes

This section discusses the configuration attributes of the encapsulation protocols that can be used on the Telindus 1431 SHDSL CPE.

The following gives an overview of this section:

- 14.5.1 - ATM configuration attributes on page 405
- 14.5.2 - Frame Relay configuration attributes on page 425
- 14.5.3 - CES configuration attributes on page 434
- 14.5.4 - PPPoA configuration attributes on page 438

14.5.1 ATM configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/wanInterface/atm/pvcTable on page 406
- telindus1431Router/wanInterface/atm/vp on page 415
- telindus1431Router/wanInterface/atm/lowSpeedPvc on page 416
- telindus1431Router/wanInterface/atm/frAtm on page 417
- telindus1431Router/wanInterface/atm/frLmiAtm on page 419
- telindus1431Router/wanInterface/atm/ces on page 420
- telindus1431Router/wanInterface/atm/atmSwitching on page 423
- telindus1431Router/<modularIf>/atm/atm on page 424

telindus1431Router/wanInterface/atm/pvcTable

Default:<empty>
Range: table, see below

Use this attribute to configure the ATM Permanent Virtual Circuits (PVCs) for routing and/or bridging the LAN data.

Refer to 9.1.3 - Configuring ATM PVCs (IP LAN PVC) on page 140 for more information on PVCs.

Important remark

- If you create ATM PVCs for routing and/or bridging the LAN data, then you have to create them in the pvcTable.
- If you create ATM PVCs for FRF purposes, then you have to create them in the frAtm table.
- If you create ATM PVCs for CES purposes, then you have to create them in the ces table.
- If you create ATM PVCs for ATM switching purposes, then you have to create them in the atmSwitching table.
- If you use both the pvcTable and the frAtm table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the frAtm table and vice versa.
- If you use both the pvcTable and the ces table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the ces table and vice versa.
- If you use both the pvcTable and the atmSwitching table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the atmSwitching table and vice versa.

The pvcTable contains the following elements:

Element	Description
name	Use this element to assign an administrative name to the PVC. Default:<empty> Range: 0 ... 24 characters
adminStatus	Use this element to activate (up) or deactivate (down) the PVC. Default:up Range: up / down
mode	Use this element to determine whether, for the corresponding PVC, the packets are treated by the routing process, the bridging process or both. Default:routing Range: enumerated, see below The mode element has the following values: • bridging. All packets received on the PVC are bridged. • routing. All packets received on the PVC are routed. • routingAndBridging. The SNAP header is checked to determine whether the packets have to be bridged or routed.
priorityPolicy	Use this element to set a priority policy per PVC. Refer to telindus1431Router/wanInterface/priorityPolicy on page 402 for more information. Default:<empty> Range: 0 ... 24 characters

Element	Description
ip	Use this element to configure the IP related parameters of the PVC. Default:- Range: structure, see below Refer to … • 5.2 - Configuring IP addresses on page 57 for general information on configuring IP addresses. • 5.2.3 - Explaining the ip structure on page 60 for a detailed description of the ip structure.
bridging	Use this element to configure the bridging related parameters of the PVC. Default:- Range: structure, see below Refer to … • 11 - Configuring bridging on page 261 for more information on bridging. • 11.2.6 - Explaining the bridging structure on page 279 for a detailed description of the bridging structure.
atm	Use this element to configure the specific PVC parameters. Default:- Range: structure, see below Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408 for a detailed description of the atm structure.
ppp	Use this element to configure the PPP related parameters of the PVC in case you choose to map PPP onto AAL5 (refer to the elements higherLayerProtocol and multiProtocolMech on page 408). Default:- Range: structure, see below Refer to 14.5.4 - PPPoA configuration attributes on page 438 for a detailed description of the elements in the ppp structure.

telindus1431Router/wanInterface/atm/pvcTable/atm

Default:-
Range: structure, see below

Use the atm structure in the pvcTable to configure the ATM related parameters of the corresponding PVC.

Refer to 9.1.3 - Configuring ATM PVCs (IP LAN PVC) on page 140 for more information on PVCs.

The atm structure contains the following elements:

Element	Description
vpi	Use this element to set the Virtual Path Identifier (VPI). Default:0 Range: 0 ... 255
vci	Use this element to set the Virtual Channel Identifier (VCI). Default:32 Range: 32 ... 65535 You can configure multiple virtual channels per virtual path. Refer to What is VPI and VCI? on page 129.
higherLayerProtocol	Use this attribute to select the protocol you want to run over ATM. Default:rfc2684 Range: enumerated, see below The higherLayerProtocol element has the following values: • rfc2684. Select this value in case you want to run bridged/routed Ethernet/IP over ATM (RFC 2684). • ppp. Select this value in case you want to run PPP over ATM (PPPoA, RFC 2364). • pppOverEthernet. Select this value in case you want to run PPP over Ethernet (PPPoE, RFC 2516). -In the PPPoE context, the Telindus 1431 SHDSL CPE can only act as a client. - If you use PPPoE on your computer, then the IP MTU size has to be limited to 1492 bytes. This is a general rule defined in the PPPoE protocol.
multiProtocolMech	Use this element to define how you want to encapsulate the higher layer protocol data in ATM. Default:llcEncapsulation Range: enumerated, see below The multiProtocolMech element has the following values: • llcEncapsulation. Logical Link Control (LLC) encapsulation multiplexes multiple protocols over a single virtual connection. The protocol type of each protocol data unit (PDU) is identified by a prefixed IEEE 802.2 Logical Link Control (LLC) header. In general, LLC encapsulation tends to require fewer VCs in a multi-protocol environment but has more fragmentation overhead. • vcMultiplexing. Virtual Circuit (VC) multiplexing uses one virtual connection to carry the PDUs of exactly one protocol type. When multiple protocols need to be transported, there is a separate VC for each. VC multiplexing tends to reduce fragmentation overhead (e.g. an IPV4 datagram containing a TCP control packet with neither IP nor TCP options exactly fits into a single cell) but needs more VCs.

Element	Description
serviceCategory	Use this element to specify the ATM service category. Default:ubr Range: enumerated, see below The serviceCategory element has the following values: cbr, vbr-rt, vbr-nrt, ubr. For more information on ATM service categories, refer to 9.1.1 - Introducing ATM on page 129.
peakCellRate	Use this element to set the Peak Cell Rate (PCR) of the PVC. Default:auto Range: auto, 64000... The peakCellRate is expressed in bps. Enter a multiple of 64000 bps as peakCellRate value (e.g. 2048000). The maximum value is the physical connection towards the ATM network. In auto mode, the PVC will try to get the maximum bandwidth, i.e. the speed of the physical connection towards the ATM network. This is the line speed on which the Telindus 1431 SHDSL CPE is trained. For more information on PCR and how to configure it, refer to … • 9.1.1 - Introducing ATM on page 129 • 9.1.7 - Configuring UBR on page 145 • 9.1.8 - Configuring VBR-nrt on page 146 • 9.1.9 - Configuring VBR-rt on page 147 • 9.1.10 - Configuring CBR on page 148
sustCellRate	Use this element to set the Sustainable Cell Rate (SCR) of the PVC. Default:<opt> Range: 0 ... The sustCellRate is expressed in bps. Enter a multiple of 64000 bps as sustCellRate value (e.g. 2048000). The maximum value is the physical connection towards the ATM network. For more information on SCR and how to configure it, refer to … • 9.1.1 - Introducing ATM on page 129 • 9.1.8 - Configuring VBR-nrt on page 146 • 9.1.9 - Configuring VBR-rt on page 147
maxBurstSize	Use this element to set the Maximum Burst Size (MBS) of the PVC. Default:<opt> Range: 0 ... 2147483647 The maxBurstSize is expressed in a number of cells (cell times). For more information on MBS and how to configure it, refer to … • 9.1.1 - Introducing ATM on page 129 • 9.1.8 - Configuring VBR-nrt on page 146 • 9.1.9 - Configuring VBR-rt on page 147
inArpTimeOut	Use this element to set the time between the transmission of two consecutive Inverse ARP frames. Default:00000d 00h 00m 30s Range: 00000d 00h 00m 01s - 00000d 01h 00m 00s

Element	Description
oamF5Loopback	Use this element to configure the transmission of OAM F5 LoopBack cells. Refer to What are OAM LoopBack (LB) cells? on page 136. Default:- Range: structure, see below Refer to telindus1431Router/wanInterface/atm/pvcTable/atm/oamF5Loopback on page 411 for a detailed description of the oamF5Loopback structure.
oamF5CC	Use this element to configure the transmission of OAM F5 Continuity Check cells. Refer to What are OAM Continuity Check (CC) cells? on page 136. Default:- Range: structure, see below Refer to telindus1431Router/wanInterface/atm/pvcTable/atm/oamF5CC on page 412 for a detailed description of the oamF5CC structure.

telindus1431Router/wanInterface/atm/pvcTable/atm/oamF5Loopback

Default:-
Range: structure, see below

Use the oamF5Loopback structure to configure the transmission of OAM F5 loopback cells.

The oamF5Loopback structure contains the following elements:

Element	Description
operation	Use this element to enable or disable loopback operation. Default:disabled Range: enabled / disabled The operation element has the following values: • disabled. Loopback operation is disabled, i.e. the loopback cells are not sent. This means that the ifOperStatus of the PVC becomes up when the ATM is synchronised globally. However, this does not guarantee that the PVC is configured (correctly) on the remote side. • enabled. Loopback operation is enabled, i.e. the Telindus 1431 SHDSL CPE sends loopback cells at regular intervals. If consecutive cells are not returned by the remote side, then the ifOperStatus of the PVC becomes down. The Telindus 1431 SHDSL CPE always responds to OAM LB cells received from the peer ATM device (both segment and end-to-end cells). However, when OAM LB is activated, the Telindus 1431 SHDSL CPE only sends end-to-end OAM LB request cells.
interval	Use this element to set the time interval between the sending of two consecutive loopback cells. Default:00000d 00h 00m 10s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s
failsPermitted	Use this element to set the number of non-returned loopback cells after which the Telindus 1431 SHDSL CPE declares the PVC down. Default:4 Range: 1 ... 30 **Example** Suppose failsPermitted is set to 10. If 10 consecutive loopback cells are not returned by the remote side, then the Telindus 1431 SHDSL CPE declares the PVC down.

telindus1431Router/wanInterface/atm/pvcTable/atm/oamF5CC

Default:-
Range: structure, see below

Use the oamF5CC structure to configure the transmission of OAM F5 continuity check cells.

The oamF5CC structure contains the following elements:

Element	Description
direction	Use this element to indicate whether this side of the PVC is the originator, the receiver or both of the CC cells. Default:sink Range: enumerated, see below The direction element has the following values: • source. This side of the PVC is the originator of the CC cells. • sink. This side of the PVC is the receiver of the CC cells. • both. This side of the PVC is both the originator and the receiver of the CC cells. The source transmits CC cells as configured in the tx structure. The sink acts as configured in the rx structure. The direction elements of both sides have to be configured correspondingly, i.e. sink/source, source/sink or both/both. Refer to Common activation/deactivation configurations on page 414 for some examples.
target	Use this element to indicate whether the CC cells are defined for the current segment (segment) or end-to-end (endToEnd). Default:endToEnd Range: segment / endToEnd The segment cells only work for the segment to which the device itself belongs (i.e. no specific coding is used for location identifiers). The target elements of both sides have to be configured correspondingly, i.e. both segment or both endToEnd.
tx	Use this structure to configure how the source transmits CC cells. This structure only applies in case you set the direction element to the value source or both. Default:- Range: structure, see below The tx structure contains the following elements: • mode. Use this element to set the transmit mode of the source. Default:onIdle Range: onIdle / interval The mode element has the following values: - onIdle. CC cells are sent in the forward direction by the source when no user cells have been sent for a period as configured in the interval element. - continuously. CC cells are sent repetitively with a periodicity of 1 cell per interval independent of the user cells flow. • interval. Use this element to determine the period of CC cell transmission. Default:00m 01s 000ms Range: 00m 00s 500ms - 10m 00s 000ms

Element	Description
rx	Use this structure to configure how the sink acts. This structure only applies in case you set the direction element to the value sink or both. Default:- Range: structure, see below The rx structure contains the following elements: • timeOut. Use this element to determine the time-out period after which the sink declares the AIS (Alarm Indication Signal) state. If the sink with CC activated does not receive any user cell or CC cell within a time interval as configured in the timeOut element, then it declares the AIS state due to a LOC (Loss of Continuity) defect. Default:00m 03s 500ms Range: 00m 00s 500ms - 10m 00s 000ms
actDeact	Use this structure to determine how the CC mechanism is activated or deactivated. Default:- Range: structure, see below The actDeact structure contains the following elements: • initProcedure. Use this element to determine how the CC mechanism is activated or deactivated. Default:passive Range: enumerated, see below The initProcedure element has the following values: - passive. The CC mechanism is activated/deactivated only when receiving activator/deactivator cells from the other side. This side will never (de)activate the CC mechanism if the other side is manually (de)activated. - activated. The CC mechanism is manually activated. This excludes the use of (de)activator cells. Also the other side has to be activated manually. - deactivated. The CC mechanism is manually deactivated. - initActivation. This side takes the initiative in activating/deactivating the CC mechanism. This means that this side sends activator/deactivator cells and starts a state machine to monitor the (de)activation state. Refer to Common activation/deactivation configurations on page 414 for some examples. • retryInterval. Use this element to set the time-out after which the activator/deactivator cells have to be resent in case no ACK cell is received. Default:00m 03s 000ms Range: 00m 00s 500ms - 10m 00s 000ms • retryCount. Use this element to set the number of times the activator/deactivator cells have to be resent in case no ACK cell is received. Default:3 Range: 3 ... 255

Common activation/deactivation configurations

Some common activation/deactivation configurations are:

Local Telindus 1431 SHDSL CPE	**Remote Telindus 1431 SHDSL CPE**	**Comments**
direction **/** initProcedure	direction **/** initProcedure	
source / initActivation	sink / passive	The local side transmits the CC cells and is the “master” in the (de)activation of the CC mechanism. The remote side receives the CC cells and is the “slave” in the (de)activation of the CC mechanism.
both / initActivation	both / passive	Both local and remote side transmit and receive CC cells. The local side is the “master” in the (de)activation of the CC mechanism and the remote the “slave”.
source / activated	sink / activated	The local side transmits the CC cells and the remote side receives the CC cells. The CC mechanism is activated manually on both sides.
both / activated	both / activated	Both local and remote side transmit and receive CC cells. The CC mechanism is activated manually on both sides.
deactivated	deactivated	The CC mechanism is deactivated.

telindus1431Router/wanInterface/atm/vp

Default:<empty>
Range: table, see below

Use this attribute to configure the transmission of OAM F4 loopback cells.

The vp table contains the following elements:

Element	Description
vpi	Use this element to enter the Virtual Path Identifier (VPI) of the Virtual Path for which you want to send the OAM F4 loopback cells. Default:0 Range: 0 ... 255
oamF4Loopback	Use this element to configure the transmission of OAM F4 LoopBack cells. Refer to What are OAM LoopBack (LB) cells? on page 136. Default:- Range: structure, see below The elements contained in this structure are the same as those in the oamF5Loopback structure. For a detailed description of these elements refer to telindus1431Router/wanInterface/atm/pvcTable/atm/oamF5Loopback on page 411.
oamF4CC	Use this element to configure the transmission of OAM F4 Continuity Check cells. Refer to What are OAM Continuity Check (CC) cells? on page 136. Default:- Range: structure, see below The elements contained in this structure are the same as those in the oamF5CC structure. For a detailed description of these elements refer to telindus1431Router/wanInterface/atm/pvcTable/atm/oamF5CC on page 412.

All entries in the vp configuration table are considered, even if for a certain VPI number no corresponding PVC has been configured. In the vp status and performance tables only the information about VPs that are configured in the vp configuration table is shown. However, the Telindus 1431 SHDSL CPE does respond to loopback requests for VPs that are not configured in the vp configuration table but for which a PVC has been configured.

telindus1431Router/wanInterface/atm/lowSpeedPvc

Default:<empty>
Range: table, see below

Use this attribute to configure a low speed ATM PVC.

Refer to 9.1.16 - Configuring a low speed ATM PVC on page 155 for more information.

When using CES, you actually use the full bandwidth of the SHDSL line. This means that under normal circumstances you would not get any additional routed or bridged data over the line. This implies that you cannot carry management data across your network when using CES.

However, when enabling the Z-bits on the SHDSL line (refer to telindus1431Router/wanInterface/line/maxNrOfZ-Bits on page 451), you can increase the bandwidth of the SHDSL line. This additional bandwidth can then be used for a low speed PVC (5 ATM cells per second). This PVC can then be used, for example, to carry management data across your network.

In the lowSpeedPvc table, you can only add 1 PVC (i.e. 1 row in the lowSpeedPvc table). This row contains the same elements as the “normal” pvcTable (refer to telindus1431Router/wanInterface/atm/pvcTable on page 406). However, because the low speed PVC has a fixed bandwidth (PCR=2120 bps (5 ATM cells per second), CDV = 1 ms), the atm structure in the lowSpeedPvc table does not contain the elements peakCellRate, sust-CellRate and maxBurstSize.

Note that the status and performance information of the low speed PVC can be found in …

- the “normal” status pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 591.
- the “normal” performance pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 702.

telindus1431Router/wanInterface/atm/frAtm

Default:<empty>
Range: table, see below

Use this attribute to configure Frame Relay DLCIs and ATM PVCs in case of Frame Relay to ATM interworking (FRF).

Refer to 6 - Configuring Frame Relay to ATM interworking on page 93 for more information on setting up FRF links.

Important remark

- If you create ATM PVCs for routing and/or bridging the LAN data, then you have to create them in the pvcTable.
- If you create ATM PVCs for FRF purposes, then you have to create them in the frAtm table.
- If you create ATM PVCs for CES purposes, then you have to create them in the ces table.
- If you create ATM PVCs for ATM switching purposes, then you have to create them in the atmSwitching table.
- If you use both the pvcTable and the frAtm table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the frAtm table and vice versa.
- If you use both the pvcTable and the ces table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the ces table and vice versa.
- If you use both the pvcTable and the atmSwitching table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the atmSwitching table and vice versa.

The frAtm table contains the following elements:

Element	Description
name	Use this element to assign an administrative name to the FRF link, i.e. the Frame Relay DLCI / ATM PVC combination. Default:<empty> Range: 0 ... 24 characters
adminStatus	Use this element to activate (up) or deactivate (down) the FRF link. Default:up Range: up / down
mode	Use this element to select the function of the corresponding FRF link. Default:frf5 Range: enumerated, see below The mode element has the following values: • frf5. The Frame Relay to ATM network interworking function (FRF.5) is selected. Refer to What is FRF.5? on page 94. • frf8. The Frame Relay to ATM service interworking function (FRF.8) is selected. Refer to What is FRF.8? on page 94.
atm	Use this element to configure the ATM related parameters. Default:- Range: structure, see below For a detailed description of the elements of this atm structure, refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 408, and more specifically to the elements vpi, vci, peakCellRate, sustCellRate, maxBurstSize, oamF5Loopback and oamF5CC.

Element	Description
frameRelay	Use this element to configure the Frame Relay related parameters. Default:- Range: structure, see below Refer to telindus1431Router/wanInterface/atm/frAtm/frameRelay on page 426 for a detailed description of this frameRelay structure.
deClpMap	Use this element to set the Frame Relay Discard Eligible (DE) to ATM Cell Loss Priority (CLP) mapping between a Frame Relay and an ATM network. Default:mode1 Range: enumerated, see below For more information, refer to … • 6.5.1 - Introducing traffic mapping on page 104 • 6.5.2 - Configuring the DE / CLP mapping on page 105
frf8	Use this element to configure some specific FRF.8 parameters. Default:- Range: structure, see below For a detailed description of the elements of this frf8 structure, refer to telindus1431Router/wanInterface/atm/frAtm/frf8 on page 418.

telindus1431Router/wanInterface/atm/frAtm/frf8

Default:-
Range: structure, see below

Use the frf8 structure in the frAtm table to configure some specific FRF.8 parameters.

Element	Description
congestionMap	Use this element to determine how the Forward Explicit Congestion Notification (FECN) to Explicit Forward Congestion Indication (EFCI) mapping occurs between a Frame Relay and an ATM network in case of FRF.8. Default:mode1 Range: enumerated, see below For more information, refer to … • 6.5.1 - Introducing traffic mapping on page 104 • 6.5.3 - Configuring congestion indication mapping on page 110
mode	Use this element to set the upper layer user protocol encapsulation for each pair of interoperable Frame Relay DLCI and ATM PVC. Default:translation Range: enumerated, see below For more information, refer to … • 6.5.1 - Introducing traffic mapping on page 104 • 6.5.4 - Configuring FRF.8 upper layer user protocol encapsulation on page 115

telindus1431Router/wanInterface/atm/frLmiAtm

Default:<empty>
Range: table, see below

Use this attribute to transport LMI over ATM in case of FRF.5.

Refer to 6.4 - Transporting LMI over ATM in case of FRF.5 on page 101 for more information.

The frLmiAtm table contains the following elements.

Element	Description
vpi	Use this element to set the Virtual Path Identifier (VPI). Default:0 Range: 0 ... 255
vci	Use this element to set the Virtual Channel Identifier (VCI). Default:32 Range: 32 ... 65535 In order to enable LMI on a particular FRF.5 link, you have to set the vpi and vci elements in the frLmiAtm table to the same values as the vpi and vci elements in the frAtm table for that particular FRF.5 link.
lmi	Use this element to enable, disable and fine-tune LMI. Default:- Range: structure, see below Refer to telindus1431Router/<modularIf>/frameRelay/lmi on page 429 for detailed information on the lmi structure.

telindus1431Router/wanInterface/atm/ces

Default:<empty>
Range: table, see below

Use this attribute to configure the ATM PVCs in case of Circuit Emulation Service (CES).

Refer to 7 - Configuring Circuit Emulation Service on page 117 for more information on setting up CES links.

Important remark

- If you create ATM PVCs for routing and/or bridging the LAN data, then you have to create them in the pvcTable.
- If you create ATM PVCs for FRF purposes, then you have to create them in the frAtm table.
- If you create ATM PVCs for CES purposes, then you have to create them in the ces table.
- If you create ATM PVCs for ATM switching purposes, then you have to create them in the atmSwitching table.
- If you use both the pvcTable and the frAtm table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the frAtm table and vice versa.
- If you use both the pvcTable and the ces table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the ces table and vice versa.
- If you use both the pvcTable and the atmSwitching table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the atmSwitching table and vice versa.

The ces table contains the following elements:

Element	Description
name	Use this element to assign an administrative name to the CES link, i.e. the ATM PVC. Default:<empty> Range: 0 ... 24 characters
adminStatus	Use this element to activate (up) or deactivate (down) the CES link. Default:up Range: up / down
atm	Use this element to configure the ATM related parameters. Default:- Range: structure, see below Refer to telindus1431Router/wanInterface/atm/ces/atm on page 421 for a detailed description of this atm structure. Note that in case of a CES ATM PVC, the Peak Cell Rate is determined by the speed element located in the syncSettings attribute. Refer to telindus1431Router/<modularIf>/ces/syncSettings on page 437.

Element	Description
intfName	Use this element to enter the name of the interface on which the CES link has to be set up Default:<empty> Range: 0 ... 24 characters **Serial modular user interface** In case of a serial modular user interface, enter in the intfName element the value of the serial interface its name attribute (refer to telindus1431Router/<serialIf>/name on page 467). By default, the name corresponds with the type of serial interface that is used, being: rs530, v35, v36 and x21. **G703 modular user interface** In case of a G703 modular user interface, enter in the intfName element the index name of the channel object. So for the channel[g703_1] object, which is present by default, you enter g703_1 in the intfName element. You can also add channels yourself. When you add a channel, then you have to specify an index name. If you want to use this channel for CES, then specify its index name in the intfName element. E.g. if you added a channel object transpChannel[my_channel], then enter my_channel in the intfName element. Refer to 5.6 - Adding CES channels on the G703 interface on page 82 for more information on adding channels.

telindus1431Router/wanInterface/atm/ces/atm

Default:-
Range: structure, see below

Use the atm structure in the ces table to configure the ATM related parameters of the corresponding CES link.

The atm structure contains the following elements:

Element	Description
vpi	Use this element to set the Virtual Path Identifier (VPI). Default:0 Range: 0 ... 255
vci	Use this element to set the Virtual Channel Identifier (VCI). Default:32 Range: 32 ... 65535 You can configure multiple virtual channels per virtual path. Refer to What is VPI and VCI? on page 129.

Element	Description
oamF5Loopback	Use this element to configure the transmission of OAM F5 LoopBack cells. Refer to What are OAM LoopBack (LB) cells? on page 136. Default:- Range: structure, see below Refer to telindus1431Router/wanInterface/atm/pvcTable/atm/oamF5Loopback on page 411 for a detailed description of the oamF5Loopback structure.
cdvtOptimisation	Use this element to enable or disable the optimisation of the Cell Delay Variation Tolerance (CDVT). Default:disabled Range: enabled / disabled Refer to 9.3.1 - Introducing CES encapsulation on page 165 for more information on network delays. The cdvtOptimisation element has the following values: • enabled. The Telindus 1431 SHDSL CPE applies a strict timing between the cells by making use of a buffer. However, this increases the Cell Transfer Delay (CTD). • disabled. The Telindus 1431 SHDSL CPE does not apply a strict timing between the cells (no buffer is used). So no extra Cell Transfer Delay (CTD) is added. However, some applications may suffer from this.

telindus1431Router/wanInterface/atm/atmSwitching

Default:<empty>
Range: table, see below

Use this attribute to configure the ATM PVCs in case of ATM switching.

Refer to 8 - Configuring ATM switching on page 123 for more information on setting up ATM switching.

Important remark

- If you create ATM PVCs for routing and/or bridging the LAN data, then you have to create them in the pvcTable.
- If you create ATM PVCs for FRF purposes, then you have to create them in the frAtm table.
- If you create ATM PVCs for CES purposes, then you have to create them in the ces table.
- If you create ATM PVCs for ATM switching purposes, then you have to create them in the atmSwitching table.
- If you use both the pvcTable and the frAtm table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the frAtm table and vice versa.
- If you use both the pvcTable and the ces table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the ces table and vice versa.
- If you use both the pvcTable and the atmSwitching table, then make sure that you do not use the same VPI/VCI indentifiers in the pvcTable as in the atmSwitching table and vice versa.

The atmSwitching table contains the following elements:

Element	Description
name	Use this element to assign an administrative name to the ATM PVC you want to relay. Default:<empty> Range: 0 ... 24 characters
atm	Use this element to configure the ATM related parameters. Default:- Range: structure, see below The atm structure contains the following elements: • vpi. Use this element to set the Virtual Path Identifier (VPI). Default:0 Range: 0 ... 255 • vci. Use this element to set the Virtual Channel Identifier (VCI). You can configure multiple virtual channels per virtual path. Refer to What is VPI and VCI? on page 129. Default:32 Range: 32 ... 65535 The ATM switching mode on the Telindus 1431 SHDSL CPE should be seen as a media conversion between E1 and SHDSL. Data is transferred in both directions with almost no delay (provided there is enough bandwidth available). No additional issues are considered. Therefore, the atmSwitching table only contains the elements VPI and VCI and nothing else (no QoS parameters etc.). So in other words, the ATM data is moved transparently from the E1 to the SHDSL line and vice versa.

telindus1431Router/<modularIf>/atm/atm

Default:-
Range: structure, see below

Use this attribute to configure the general ATM parameters of the modular user interface. This is only relevant in case you set the encapsulation attribute to atm. Refer to telindus1431Router/<modularIf>/encapsulation on page 457.

The atm structure contains the following elements:

Element	Description
idleCellFormat	Use this element to set the format of the ATM idle cells. These cells are transmitted when no data is transmitted over the line. I.e. the line is idle. Default:itu Range: enumerated, see below The idleCellFormat element has the following values: • itu. Sets the cells according to the ITU-T format. In this case they are effectively called “idle cells”. • atmForum. Sets the cells according to the ATM forum format. In this case they are actually called “unassigned cells”. Some devices use the ITU-T format, others the ATM forum format. Should the performance attribute telindus1431Router/wanInterface/atm/unknownCells increase rapidly, then try selecting a different format. However, the default value suffices in most cases.
scrambling	Use this element to enable or disable scrambling. Default:enabled Range: enabled / disabled Scrambling is designed to randomise the pattern of 1s and 0s carried in ATM cells or the physical layer frame. Randomising the digital bits can prevent continuous, non-variable bit patterns, in other words long strings of all 1s or all 0s. Several physical layer protocols rely on transitions between 1s and 0s to maintain clocking.
coset	Use this element to enable or disable coset polynomial algorithm. Default:enabled Range: enabled / disabled The coset polynomial algorithm is used to do header error check calculations.

14.5.2 Frame Relay configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/wanInterface/atm/frAtm/frameRelay on page 426
- telindus1431Router/<modularIf>/frameRelay/lmi on page 429
- telindus1431Router/wanInterface/frameRelay/delayOptimisation on page 431
- telindus1431Router/wanInterface/frameRelay/mru on page 431
- telindus1431Router/<modularIf>/frameRelay/syncSettings on page 432

telindus1431Router/wanInterface/atm/frAtm/frameRelay

Default:-
Range: structure, see below

Use the frameRelay structure in the frAtm table to configure the Frame Relay related parameters of the corresponding FRF link.

Refer to …

- 6.2 - Setting up FRF links on page 95 for more information on FRF.
- 9.2.3 - Configuring CIR and EIR on page 162 for more information on CIR and EIR.

The frameRelay structure contains the following elements:

Element	Description
dlci	Use this element to set the Data Link Connection Identifier (DLCI) in the local Frame Relay network (also see the destinationDlci element). Default:16 Range: 16 ... 1022 The DLCI number may have any value between 16 and 1022. However, if you set the type element of the lmi structure to q933-Annex-A, you should only use DLCIs up to 1007.
destinationDlci	This element is only relevant in case of FRF.5. Default:1022 Range: 16 ... 1022 Use this element to set the Data Link Connection Identifier (DLCI) in the remote Frame Relay network (also see the dlci element). In case of FRF.5 you go from a local Frame Relay network, through an ATM network to a remote Frame Relay network. You are able to define a different DLCI in the local Frame Relay network than in the remote Frame Relay network. Use the … • dlci element to set the DLCI in the local Frame Relay network. • destinationDlci element to set the DLCI in the remote Frame Relay network.
cir	Use this element to set the Committed Information Rate for the DLCI. Default:0 Range: 0 ... The cir is expressed in bps. Enter a multiple of 64000 bps as cir value (e.g. 2048000). The maximum value is the physical connection towards the Frame Relay network. If the cir value is set to 0 (default), it means the complete bandwidth may be used (no flow control).
eir	Use this element to set the Excess Information Rate for the DLCI. Default:0 Range: 0 ... The eir is expressed in bps. Enter a multiple of 64000 bps as eir value (e.g. 2048000). The maximum value is the physical connection towards the Frame Relay network. If the eir value is set to 0 (default), it means no excess burst is allowed. The bursts of data that are allowed are the CIR value + EIR value. I.e. If you want a CIR of 1 Mbps and you want to allow bursts up to 1.5 Mbps, then set the CIR to 1024000 bps and the EIR to 512000 bps.

Element	Description
deBitSet	Use this element to determine, in case the CIR is exceeded, whether all subsequent frames get marked Discard Eligible (deBitSet = enabled) or not (deBitSet = disabled). Default:enabled Range: enabled / disabled If congestion occurs at a node in the Frame Relay network, packets marked DE are the first to be dropped.
rxCir	Use this element to set the receive Committed Information Rate for the DLCI. Default:0 Range: 0 ... Whereas the cir element is the Committed Information Rate for the *outgoing* traffic on a DLCI, the rxCir element is the Committed Information Rate for the *incoming* traffic on a DLCI. So using the latter you can also limit the incoming data stream on a DLCI. Also see rxCir, rxEir and rxExcess relationship on page 428.
rxEir	Use this element to set the receive Excess Information Rate for the DLCI. Default:0 Range: 0 ... Whereas the eir element is the Excess Information Rate for the *outgoing* traffic on a DLCI, the rxEir element is the Excess Information Rate for the *incoming* traffic on a DLCI. So using the latter you can also limit the incoming data stream on a DLCI. Also see rxCir, rxEir and rxExcess relationship on page 428.
rxExcess	Use this element to determine which action is taken in case the rxCir is exceeded (i.e. what is done with the data that exceeds the rxCir rate). Default:discard Range: enumerated, see below The rxExcess element has the following values: **Value** / **All data above the rxCir rate but below the rxCir+rxEir rate is ...** discard — dropped. setDeBit — passed but marked Discard Eligible. ignore — passed. Also see rxCir, rxEir and rxExcess relationship on page 428.

rxCir, rxEir and rxExcess relationship

The following table shows the rxCir, rxEir and rxExcess relationship:

rxCir	rxEir	rxExcess	Behaviour
0	any value	any value	This is the default situation. In this case the incoming bandwidth is not checked.
different from 0	any value	discard	All data above the rxCir rate is discarded (and counted as ifOutDiscards).
different from 0	any value	setDeBit	All data between the rxCir and rxCir+rxEir rate is marked Discard Eligible. All data above the rxCir+rxEir rate is discarded (and counted as ifOutDiscards).
different from 0	any value	ignore	All data between the rxCir and rxCir+rxEir rate is passed. All data above the rxCir+rxEir rate is discarded (and counted as ifOutDiscards).

telindus1431Router/<modularIf>/frameRelay/lmi

Default:-
Range: structure, see below

Use this attribute to select the Local Management Interface (LMI) protocol and to fine-tune the LMI operation.

Refer to 9.2.2 - Configuring LMI on page 161 for more information on LMI.

The lmi structure contains the following elements:

Element	Description
mode	Use this element to set the Frame Relay mode. Default:auto Range: enumerated, see below The mode element has the following values: • noLmi. No LMI is used. • user. In the LMI context, the Telindus 1431 SHDSL CPE is defined as Frame Relay user. This means it only sends Status Enquiries and receives Status Responses. • network. In the LMI context, the Telindus 1431 SHDSL CPE is defined as Frame Relay network. This means it only receives Status Enquiries and sends Status Responses. • auto. In the LMI context, the Telindus 1431 SHDSL CPE is both Frame Relay user and Frame Relay network. This means it can both send and receive Status Enquiries and Status Responses. At initialisation, the Telindus 1431 SHDSL CPE sends the first Full Status Enquiry. As soon as it gets a Full Status Response, it declares that LMI is up. If you use the Telindus 1431 SHDSL CPE in combination with equipment from another vendor and you set the LMI mode to auto, then the LMI mode on the other equipment may only be set to user or network to insure valid operation. • nni. In the LMI context, the Telindus 1431 SHDSL CPE is both Frame Relay user and Frame Relay network. This means it can both send and receive Status Enquiries and Status Responses. In a Network-to-Network Interface (NNI) it is important for the connected Frame Relay devices that they know which DLCIs are configured on each side. Therefore, in comparison with the auto setting, one extra step is required before LMI is declared to be up. So at initialisation, the Telindus 1431 SHDSL CPE sends the first Full Status Enquiry and receives a Full Status Response. Then it waits until it receives a Full Status Enquiry from the remote before it declares that LMI is up. Refer to Interaction between the LMI modes on page 431 for an overview of how the different LMI modes work together.

Element	Description
type	Use this element to set the LMI variant. There are several standards for the LMI protocol with small variations between them. Therefore you should configure the Telindus 1431 SHDSL CPE according to the standard that is used by your service provider. Default:q933-Annex-A Range: enumerated, see below The type element has the following values: • lmiRev1. Set this value only for compatibility with older equipment. • ansiT1-617-d. Set this value for ANSI LMI compliance. • q933-Annex-A. Set this value for ITU-T LMI compliance. • frf1-2. Set this value for FRF.1-2 compliance.
pollingInterval	Use this element to set the time between consecutive Status Enquiry messages. Default:00000d 00h 00m 10s Range: 00000d 00h 00m 05s - 00000d 00h 00m 30s
errorThreshold	Use this element to set the maximum number of unanswered Status Enquiry messages that the Telindus 1431 SHDSL CPE will accept before declaring the DLCI down. Also see the monitoredEvents element. Default:3 Range: 1 ... 10
monitoredEvents	Use this element to set the number of status polling intervals over which the error threshold is counted. Default:4 Range: 1 ... 10 In other words, if the station receives an errorThreshold number of unanswered Status Enquiry messages within a monitoredEvents number of pollingInterval intervals, then the interface is declared down. **Example** If the station receives 3 unanswered Status Enquiry messages within 4 x 10s = 40s, then the interface is declared down.
expectedPollInterval	Use this element to set the maximum time between two consecutive incoming Status Enquiry messages. Select the value 0 in order to disable verification. Default:00000d 00h 00m 15s Range: 00000d 00h 00m 00s - 00000d 00h 00m 30s This element is only relevant when using Frame Relay over a point-to-point link (no Frame Relay network). In Frame Relay language, a router is normally considered as a Frame Relay user or DTE. However, if two routers are connected to each other in Frame Relay but without a real Frame Relay network in between, then the routers also have to take the role of a Frame Relay network or DCE (refer to the mode element). In that case the Status Enquiry messages are sent in both directions.
fullEnquiryInterval	Use this element to set the number of Status Enquiry intervals that have to pass before sending a Full Status Enquiry message. Default:6 Range: 1 ... 255

Interaction between the LMI modes

The following table shows how the different LMI modes work together when two routers are connected to each other over a Frame Relay network:

LMI mode		LMI status		DLCI status		Router learns DLCIs?	
Router A	**Router B**	**Router A**	**Router B**	**Router A**	**Router B**	**Router A**	**Router B**
noLmi	noLmi	up	up	up	up	no	no
	user	up	down	up	down	no	no
	network	up	down	up	down	no	no
	nni	up	down	up	down	no	no
	auto	up	down	up	down	no	no
user	user	down	down	down	down	no	no
	network	up	up	up	up	learns (user)	no
	nni	up	down	up	down	learns (user)	no
	auto	up	up	up	up	learns (user)	no
network	network	down	down	down	down	no	no
	nni	up	down	up	down	no	learns (nni)
	auto	up	up	up	up	no	learns (auto)
nni	nni	up	up	up	up	learns	learns
	auto	up	up	up	up	learns	learns
auto	auto	up	up	up	up	learns	learns

telindus1431Router/wanInterface/frameRelay/delayOptimisation

Default:none
Range: none / lowSpeedLinks

Use this attribute to reduce the delay on low speed links. Especially if these links have to transport delay sensitive data (e.g. voice over IP).

telindus1431Router/wanInterface/frameRelay/mru

Default:1560
Range: 500 ... 1650

Use this attribute to set the Maximum Receive Unit (MRU) of the interface.

What is MRU?

The Maximum Receive Unit (MRU) is the largest size packet or frame, specified in octets (eight-bit bytes), that can be received in a packet- or frame-based network (e.g. the Internet).

telindus1431Router/<modularIf>/frameRelay/syncSettings

Default:-
Range: structure, see below

Use this attribute to select a clocking mode and speed in case FRF is in use.

This attribute is only present in case you use a serial interface (RS530, V35, V36 or X21). In case of a G703 interface, use the telindus1431Router/g703/clocking attribute to set the clocking.

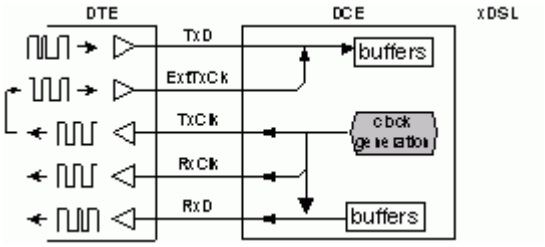
The syncSettings structure contains the following elements:

Element	Description
clocking	Use this element to set the clocking mode. Default:internalPreferred Range: enumerated, see below The clocking element has the following values: • internalPreferred • internalAlternative • slaveOnNetworkPreferred • slaveOnNetworkAlternative • external Refer to The clocking modes explained on page 433, for more detailed information on the clocking modes. The Telindus 1431 SHDSL CPE does not provide a fallback mechanism from preferred to alternative clocking mode or vice versa. For more remarks see Important remarks on clocking on the serial interfaces on page 81.
speed	Use this element to set the interface (transmit) clock speed. In case of external clocking, the speed element has no function. In case of slave on network clock, the interface clock is locked to the 8kHz network clock at the configured speed. Default:2048000 Range: 64000 ... 2048000 / 4096000 Enter a speed between 64000 bps up to 2048000 bps in steps of 64000 bps. In case of a Telindus 1431 SHDSL CPE 2 pair version, the maximum speed is 4096000 bps.

The clocking modes explained

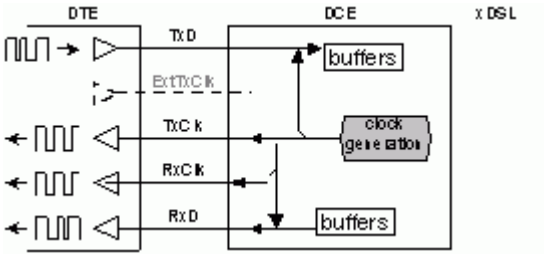
Internal preferred clocking

An internal clock generator generates the TxClk and RxClk. The RxClk is used to clock the receive data out. The TxClk is looped by the DTE and becomes the ExtTxClk. The ExtTxClk is used to clock the transmit data in.



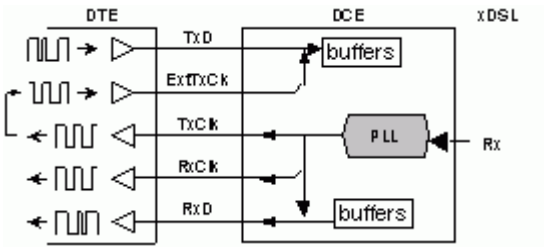
Internal alternative clocking

An internal clock generator generates the TxClk and RxClk. The RxClk is used to clock the receive data out. The TxClk is used to clock the transmit data in.



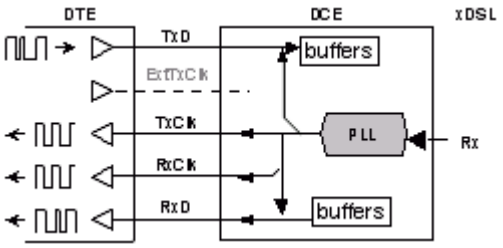
Slave on network preferred clocking

The TxClk and RxClk are derived from the received line data. The RxClk is used to clock the receive data out. The TxClk is looped by the DTE and becomes the ExtTxClk. The ExtTxClk is used to clock the transmit data in.



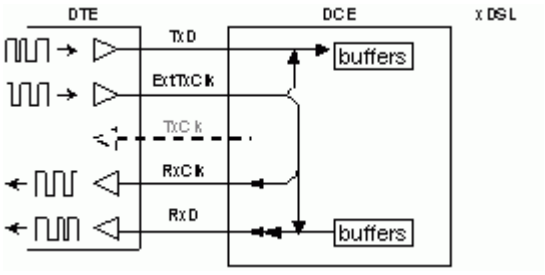
Slave on network alternative clocking

The TxClk and RxClk are derived from the received line data. The RxClk is used to clock the receive data out. The TxClk is used to clock the transmit data in.



External clocking (FRF only)

The DTE generates the ExtTxClk. The ExtTxClk is used to clock the receive data out and to clock the transmit data in.



14.5.3 CES configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/<modularIf>/ces/maxCellVariation on page 435
- telindus1431Router/<modularIf>/ces/fillSize on page 435
- telindus1431Router/<modularIf>/ces/sdtMethod on page 436
- telindus1431Router/<modularIf>/ces/syncSettings on page 437

telindus1431Router/<modularIf>/ces/maxCellVariation

Default:8
Range: 2 ... 40

Use this attribute to absorb the Cell Delay Variation (CDV), also called jitter.

Refer to 9.3.1 - Introducing CES encapsulation on page 165 for more information on network delays.

Using this attribute you actually define how many cells the CES IWF stores before emptying the ATM cell buffer. The maxCellVariation is always half the buffer size. So if you configure a maxCellVariation of 4, then the complete buffer size is 8.

When you define a buffer which is too …

- small, then you can not absorb the Cell Delay Variation (CDV). This results in buffer over- or under-runs.
- large, then you add a measurable amount of delay to the overall Cell Transfer Delay (CTD).

Therefore, it is important to emphasise that the maxCellVariation should optimise the jitter versus absolute delay trade-off. So set the maxCellVariation to a …

- small value if the end-to-end path will produce minimal CDV.
- large value if the end-to-end path will produce large CDV.

The maxCellVariation has an impact on the receive side only, i.e. from the ATM network to the serial or E1 interface.

telindus1431Router/<modularIf>/ces/fillSize

Default:47
Range: 1 ... 47

Use this attribute to determine with how many bytes a cell is filled before it is sent.

Refer to 9.3.1 - Introducing CES encapsulation on page 165 for more information on network delays.

A significant source of delay is the cell payload assembly delay, or the amount of time it takes to collect enough data to fill a cell. This period of time can be reduced by sending cells that are only partially full, rather than waiting for a full 47-byte payload before sending each cell. This reduces overall delay at the expense of a higher cell rate.

The fillSize only has an impact on the transmit side only, i.e. from the serial or E1 interface to the ATM network.

telindus1431Router/<modularIf>/ces/sdtMethod

Default:disabled
Range: enabled / disabled

Use this attribute to select between unstructured (disabled) or structured (enabled) CES.

For more information on unstructured or structured CES, refer to What is structured versus unstructured CES? on page 118.

- If you use a G703 interface at one side and a serial interface at the other side of the link, then set the sdtMethod attribute to disabled.
- When setting the sdtMethod attribute to disabled, then less bandwidth on ATM is used for the CBR CES channel.

telindus1431Router/<modularIf>/ces/dataBitsReversed

Default:enabled
Range: enabled / disabled

Use this attribute to enable or disable the reversing of the bits within a byte before putting them into the payload of ATM cells.

To be compatible with most other vendors (e.g. Fore and Cisco Catalyst switches), the dataBitsReversed attribute has to be enabled (default value).

Note that in application software version T2855/00100, the dataBitsReversed attribute was not present. It was fixed to dataBitsReversed = disabled. This means that application software versions T2855/00200 and higher are not compatible with application software version T2855/00100, unless you set the dataBitsReversed attribute to disabled.

telindus1431Router/<modularIf>/ces/syncSettings

Default:-
Range: structure, see below

Use this attribute to select a clocking mode and speed in case CES is in use.

This attribute is only present in case you use a serial interface (RS530, V35, V36 or X21). In case of a G703 interface, use the telindus1431Router/g703/clocking attribute to set the clocking.

The syncSettings structure contains the following elements:

Element	Description
clocking	Use this element to set the clocking mode. Default:slaveOnNetwork-Preferred Range: enumerated, see below The clocking element has the following values: • internalPreferred • internalAlternative • slaveOnNetworkPreferred • slaveOnNetworkAlternative Refer to The clocking modes explained on page 433, for more detailed information on the clocking modes. The Telindus 1431 SHDSL CPE does not provide a fallback mechanism from preferred to alternative clocking mode or vice versa. For more remarks see Important remarks on clocking on the serial interfaces on page 81.
speed	Use this element to set the clock speed. This speed also determines the Peak Cell Rate of the CES ATM PVC. In case of slave on network clock, the interface clock is locked to the 8kHz network clock at the configured speed. Default:2048000 Range: 64000 ... 2048000 / 4096000 Enter a speed between 64000 bps up to 2048000 bps in steps of 64000 bps. In case of a Telindus 1431 SHDSL CPE 2 pair version, the maximum speed is 4096000 bps.

14.5.4 PPPoA configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/wanInterface/atm/pvcTable/ppp/compression on page 439
- telindus1431Router/wanInterface/atm/pvcTable/ppp/linkMonitoring on page 440
- telindus1431Router/wanInterface/atm/pvcTable/ppp/authentication on page 441
- telindus1431Router/wanInterface/atm/pvcTable/ppp/authenPeriod on page 441
- telindus1431Router/wanInterface/atm/pvcTable/ppp/sessionName on page 442
- telindus1431Router/wanInterface/atm/pvcTable/ppp/sessionSecret on page 442

telindus1431Router/wanInterface/atm/pvcTable/ppp/compression

Default:disabled
Range: enumerated, see below

Use this attribute to enable or disable the compression of PPP encapsulated packets.

The compression attribute has the following values:

Value	Description
disabled	No PPP compression is done.
predictor1	PPP compression is done using the Predictor type 1 compression algorithm (RFC 1978). Using compression you can increase the throughput on PPP links.

Important remark

The PPP compression algorithm uses a lot of memory (64 KB for compression and 64 KB for decompression, per PPP session). Since it is possible to have multiple PPP sessions (when using ATM PVCs up to 31 simultaneous sessions are allowed, which can all be configured to use PPP compression), the memory can turn out to be insufficient. In this case …

- the compression is switched off on the interfaces that could not allocate enough memory,
- a message is dumped in the message table, containing the relevant interface and a warning that the router must be rebooted to reactivate compression on that specific interface.

It is also possible that, when looking at the statistics, enough memory seems to be available but that the allocation problem remains. This means that the memory is fragmented and no block as big as 64 KB is found.

telindus1431Router/wanInterface/atm/pvcTable/ppp/linkMonitoring

Default:-
Range: structure, see below

Use this attribute to enable or disable link monitoring and to fine-tune it.

Refer to 9.4.5 - Configuring link monitoring on page 175 for more information on link monitoring.

The linkMonitoring structure contains the following elements:

Element	Description
operation	Use this element to enable or disable link monitoring. Default:disabled Range: enabled / disabled
interval	Use this element to set the time interval between two consecutive echo requests. Default:00000d 00h 00m 10s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s
replyTimeOut	Use this element to set the time the Telindus 1431 SHDSL CPE waits for a reply on the echo request. If no reply has been received within this time-out, then the Telindus 1431 SHDSL CPE considers this as a failed echo request. Default:00000d 00h 00m 02s Range: 00000d 00h 00m 00s - 00000d 00h 04m 15s
failsPermitted	Use this element to set the number of failed echo requests after which the Telindus 1431 SHDSL CPE declares the PPP link down. Default:4 Range: 1 ... 30 **Example** Suppose failsPermitted is set to 10. If on 10 consecutive echo requests no reply is given, then the Telindus 1431 SHDSL CPE declares the PPP link down and the PPP handshake is started again.

telindus1431Router/wanInterface/atm/pvcTable/ppp/authentication

Default:disabled
Range: enumerated, see below

Use this attribute to enable or disable authentication on the PPP link.

For more information on PPP authentication, refer to …

- 9.4.6 - Configuring PAP on page 176.
- 9.4.8 - Configuring CHAP on page 179.

The authentication attribute has the following values:

Value	Description
disabled	Authentication is disabled. However, the Telindus 1431 SHDSL CPE will answer to authentication requests received from the remote side.
pap	This side of the link requests a PAP authentication from the remote router.
chap	This side of the link requests a CHAP authentication from the remote router.
chapOrPap	This side of the link requests a CHAP or PAP authentication from the remote router. If the remote router supports … • only PAP, then PAP is used. • only CHAP, then CHAP is used. • both CHAP and PAP, then CHAP is used.
msChap	This side of the link requests an MS CHAP version 1 authentication from the remote router.
msChapV2	This side of the link requests an MS CHAP version 2 authentication from the remote router.

telindus1431Router/wanInterface/atm/pvcTable/ppp/authenPeriod

Default:00000d 00h 10m 00s
Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s

Use this attribute to set the PPP authentication interval.

Normally on an authenticated PPP link, authentication is not only performed at link set-up but also at regular intervals during the data transfer. You can set this interval using the authenPeriod attribute. If you set the authenPeriod attribute to 00000d 00h 00m 00s, then authentication is only performed at link set-up and not during the data transfer.

For more information on PPP authentication, refer to …

- 9.4.6 - Configuring PAP on page 176.
- 9.4.8 - Configuring CHAP on page 179.

telindus1431Router/wanInterface/atm/pvcTable/ppp/sessionName

Default:<empty>
Range: 0 ... 64 characters

Use this attribute to set the PPP authentication name of the Telindus 1431 SHDSL CPE.

For more information on PPP authentication, refer to …

- 9.4.6 - Configuring PAP on page 176
- 9.4.8 - Configuring CHAP on page 179

telindus1431Router/wanInterface/atm/pvcTable/ppp/sessionSecret

Default:<empty>
Range: 0 ... 64 characters

Use this element to set the PPP authentication secret of the Telindus 1431 SHDSL CPE.

For more information on PPP authentication, refer to …

- 9.4.6 - Configuring PAP on page 176
- 9.4.8 - Configuring CHAP on page 179

14.6 SHDSL line configuration attributes

This section describes the following line configuration attributes:

- telindus1431Router/wanInterface/line/channel on page 444
- telindus1431Router/wanInterface/line/region on page 444
- telindus1431Router/wanInterface/line/retrain on page 445
- telindus1431Router/wanInterface/line/startupMargin on page 447
- telindus1431Router/wanInterface/line/minSpeed on page 447
- telindus1431Router/wanInterface/line/maxSpeed on page 447
- telindus1431Router/wanInterface/line/minSpeed2P on page 448
- telindus1431Router/wanInterface/line/maxSpeed2P on page 448
- telindus1431Router/wanInterface/line/mode on page 448
- telindus1431Router/wanInterface/line/dualPairMode on page 448
- telindus1431Router/wanInterface/line/linkAlarmThresholds on page 450
- telindus1431Router/wanInterface/line/eocHandling on page 451
- telindus1431Router/wanInterface/line/management on page 451
- telindus1431Router/wanInterface/line/maxNrOfZBits on page 451
- telindus1431Router/wanInterface/line/testDuration on page 451
- telindus1431Router/wanInterface/line/<alarmConfigurationAttributes> on page 452

This section describes the following line pair configuration attributes:

- telindus1431Router/wanInterface/line/linePair[ ]/<alarmConfigurationAttributes> on page 452

telindus1431Router/wanInterface/line/channel

Default:remote
Range: central / remote

Use this attribute to determine which unit is the central unit and which the remote unit. I.e. it determines which unit acts as master and which as slave during the synchronisation procedure. Therefore set one device to central and its remote counterpart to remote.

Depending on which function you select (CES or FRF), it is possible that the channel attribute influences the clocking. In case of …

- FRF, the channel attribute does not influence the clocking. You can select any clocking mode using the clocking attribute on the modular user interface.
- CES, the clocking follows the channel attribute:

If the channel attribute is set to …	then the clocking is set to …
central	internal.
remote	slave on network.

You can only use the clocking attribute on the modular user interface to select between preferred or alternative clocking.

telindus1431Router/wanInterface/line/region

Default:auto
Range: enumerated, see below

Use this attribute to determine which SHDSL standard is used.

The region attribute has the following values:

Value	Description
annexA	The North-American SHDSL standard is used.
annexB	The European SHDSL standard is used.
auto	The Telindus 1431 SHDSL CPE itself determines which standard it has to use.

telindus1431Router/wanInterface/line/retrain

Default:-
Range: structure, see below

Use this attribute to determine when the Telindus 1431 SHDSL CPE should retrain.

The retrain criteria

The following criteria determine when to retrain:

Criterion	Description
no SHDSL frame synchronisation	When the Telindus 1431 SHDSL CPE cannot synchronise on the SHDSL framing, it retrains.
SHDSL frame CRC error threshold exceeded	SHDSL framing sends 166 blocks per second over the line, independently of the speed. Each block has a CRC check. When a certain percentage of frames has a CRC error, the Telindus 1431 SHDSL CPE retrains.
signal to noise ratio too low	When the signal to noise ratio becomes too low during a certain period of time, the Telindus 1431 SHDSL CPE retrains.
layer 2 protocol not yet up	When you connect the Telindus 1431 SHDSL CPE with a remote SHDSL device, the Telindus 1431 SHDSL CPE trains and establishes a layer 1 link with the remote SHDSL device. Then the Telindus 1431 SHDSL CPE tries to establish a layer 2 link (e.g. PPP, FR, ATM). If the layer 2 handshake does not succeed within 1 minute, then the Telindus 1431 SHDSL CPE retrains and the whole process restarts. Also the following message is dumped in the message table: `Retrain due to framer-out-of-sync`. However, once the layer 2 handshake succeeds (layer 2 is up), then a drop of the layer 2 link will not cause a retrain.

Configuring the retrain criteria

The retrain structure contains the following elements:

Element	Description
enabled	Use this attribute to enable (yes) or disable (no) retraining. So when selecting no, the Telindus 1431 SHDSL CPE will never retrain (even not when the line is disconnected). Default:yes Range: yes / no
errorPersistence-Time	Use this element to set the period, in seconds, during which each retrain criterion is measured. If within this period the predefined criterion value is equalled or exceeded, the Telindus 1431 SHDSL CPE retrains. Default:10 Range: 1 ... 30
errorThreshold	Use this element to set the amount of CRC errors, in promille, at which the Telindus 1431 SHDSL CPE should retrain. If the amount of CRC errors exceeds this value, then the Telindus 1431 SHDSL CPE retrains. Default:10 Range: 1 ... 1000 The erroneous SHDSL frames can be monitored using the performance attribute codeViolations.
snrThreshold	Use this element to set the signal to noise ratio, in dB, which has to be maintained. If the measured signal to noise ratio drops below this value, then the Telindus 1431 SHDSL CPE retrains. It will retrain at a lower speed (because of the deteriorated line conditions). Default:23 Range: 20 ... 25
stepupMargin	In case the Telindus 1431 SHDSL CPE retrains because the measured signal to noise ratio drops below the snrThreshold value, then it will retrain at a lower speed (because of the deteriorated line conditions). Default:disabled Range: 3 ... 15 If after this retrain the measured signal to noise value increases again with a value as configured in the stepupMargin element, then the Telindus 1431 SHDSL CPE retrains again in order to achieve a higher speed.

telindus1431Router/wanInterface/line/startupMargin

Default:2dB
Range: enumerated, see below

Use this attribute to set the target margin in function of which a line speed has to be selected during the ITU-T G.994.1 auto speed negotiation.

The startupMargin attribute is only relevant in case on both the central and remote Telindus 1431 SHDSL CPE (or any other compatible SHDSL device) a speed *range* is selected. In other words, the startupMargin attribute has no function in case a *fixed* speed is selected (i.e. minSpeed(2P) = maxSpeed(2P)).

The higher the startupMargin, the lower the selected line speed but the more stable the line will be. The startupMargin attribute has the following values: disabled, 0dB, 1dB, 2dB, 3dB, 4dB, 5dB, 6dB, 7dB, 8dB, 9dB, 10dB. When you set the startupMargin to disabled, the target margin is not considered during the ITU-T G.994.1 auto speed negotiation. I.e. all the speeds in the range as set with the attributes minSpeed(2P) and maxSpeed(2P) are available.

What is the target margin?

The target margin is the amount of received signal power in excess of that required to achieve the DSL target bit error rate of 10^{-7}.

telindus1431Router/wanInterface/line/minSpeed

Default:64kbps
Range: enumerated, see below

Use this attribute to set the lowest line speed the Telindus 1431 SHDSL CPE may select. The minSpeed attribute has the following values: 64kbps up to 2304kbps in steps of 64kbps.

Refer to 5.3.2 - Selecting an SHDSL line speed (range) on page 70 for more information.

telindus1431Router/wanInterface/line/maxSpeed

Default:2304kbps
Range: enumerated, see below

Use this attribute to set the highest line speed the Telindus 1431 SHDSL CPE may select. The maxSpeed attribute has the following values: 64kbps up to 2304kbps in steps of 64kbps.

Refer to 5.3.2 - Selecting an SHDSL line speed (range) on page 70 for more information.

telindus1431Router/wanInterface/line/minSpeed2P

Default:128kbps
Range: enumerated, see below

This attribute is only present on the Telindus 1431 SHDSL CPE 2 pair version.

Use this attribute to set the lowest line speed the Telindus 1431 SHDSL CPE 2 pair version may select (if it is truly in 2 pair operation, refer to telindus1431Router/wanInterface/line/mode). The minSpeed2P attribute has the following values: 128kbps up to 4608kbps in steps of 128kbps.

Refer to 5.3.2 - Selecting an SHDSL line speed (range) on page 70 for more information.

telindus1431Router/wanInterface/line/maxSpeed2P

Default:2304kbps
Range: enumerated, see below

This attribute is only present on the Telindus 1431 SHDSL CPE 2 pair version.

Use this attribute to set the highest line speed the Telindus 1431 SHDSL CPE 2 pair version may select (if it is truly in 2 pair operation, refer to telindus1431Router/wanInterface/line/mode). The maxSpeed2P attribute has the following values: 128kbps up to 4608kbps in steps of 128kbps.

Refer to 5.3.2 - Selecting an SHDSL line speed (range) on page 70 for more information.

telindus1431Router/wanInterface/line/mode

Default:dualPair
Range: singlePair / dualPair

This attribute is only present on the Telindus 1431 SHDSL CPE 2 pair version.

Use this attribute to select between single pair or dual pair operation. When you change the mode attribute, then make sure that you use the correct speed attributes to set the speed:

If the mode **attribute is set to …**	**then configure the speed using the attributes …**
singlePair,	minSpeed and maxSpeed.
dualPair,	minSpeed2P and maxSpeed2P.

telindus1431Router/wanInterface/line/dualPairMode

Default:standard
Range: standard / enhanced

This attribute is only present on the Telindus 1431 SHDSL CPE 2 pair version.

If the mode attribute is set to dualPair, then use the dualPairMode attribute to set the dual pair operation mode. The dualPairMode attribute has the following possible values:

Value	**Description**
standard	The dual pair SHDSL line operates strictly as described in the SHDSL standard. If the Telindus 1431 SHDSL CPE is connected to a remote device that operates strictly according to the SHDSL standard, then select the standard value.
enhanced	The dual pair SHDSL line operates slightly different than described in the SHDSL standard (some enhancements are present). If you select the enhanced value, then it is possible that you experience problems when connecting to third party SHDSL devices. In that case, select the standard value.

If you have two Telindus 1431 SHDSL CPEs connected to each other in a point-to-point set-up, then make sure that you set the dualPairMode attribute to the same value at both sides!

telindus1431Router/wanInterface/line/linkAlarmThresholds

Default:-
Range: structure, see below

Use this attribute to set the alarm threshold values of the most important line parameters. If this predefined threshold value is exceeded, then a corresponding alarm is generated.

The linkAlarmThresholds structure contains the following elements:

Element	Description
lineAttenuationOn	Use this element to set the alarm threshold value of the line attenuation in dB. If the line attenuation … Default:0.0 Range: 0.0 ... 63.5 • exceeds this value during at least 10 seconds, then the lineAttenuation alarm is raised. • drops below this value during at least 10 seconds, then the lineAttenuation alarm is cleared.
signalNoiseOn	Use this element to set the alarm threshold value of the signal noise in dB. If the signal noise … Default:0.0 Range: 0.0 ... 58.4 • drops below this value during at least 10 seconds, then the signalNoise alarm is raised. • exceeds this value during at least 10 seconds, then the signalNoise alarm is cleared.
errSecOn	Use this element to set the alarm threshold value of the erroneous seconds in days, hours, minutes and seconds. If the amount of erroneous seconds … Default:00000d 00h 00m 36s Range: 00000d 00h 00m 00s - 00000d 18h 12m 15s • exceeds this value within a 15 minutes period[1], then the errSecExceeded alarm is raised. • drops below this value within a 15 minutes period, then the errSecExceeded alarm is cleared.
sevErrSecOn	Use this element to set the alarm threshold value of the severely erroneous seconds in days, hours, minutes and seconds. If the amount of severely erroneous seconds … Default:00000d 00h 00m 02s Range: 00000d 00h 00m 00s - 00000d 18h 12m 15s • exceeds this value within a 15 minutes period[1], then the sevErrSecExceeded alarm is raised. • drops below this value within a 15 minutes period, then the sevErrSecExceeded alarm is cleared.

1. The 15 minutes periods run synchronous with the 15 minutes periods of the telindus1431Router/wanInterface/line/h2Line performance attribute.
   Because alarms are raised or cleared within 15 minutes periods, there is a delay in the alarm status. For example, suppose that in the first minute of a 15 minutes period the errSecOn value is exceeded, then the errSecExceeded alarm is raised. The alarm stays on for the remainder of the 15 minutes period. The alarm is only cleared if also in the next 15 minutes period the errSecOn value is not exceeded.

telindus1431Router/wanInterface/line/eocHandling

Default:none
Range: enumerated, see below

SHDSL devices can communicate with each other through the Embedded Operations Channel (EOC). Use the eocHandling attribute to define the handling of the EOC messages.

Refer to 5.4.3 - Controlling the standard EOC message exchange on page 74 for more information.

telindus1431Router/wanInterface/line/management

Default:o10-PathManagement
Range: enumerated, see below

Use this attribute to determine whether and which management data is forwarded over the SHDSL line.

Refer to 5.4.2 - Controlling the proprietary EOC message exchange on page 73 for more information.

telindus1431Router/wanInterface/line/maxNrOfZBits

Default:1
Range: 0 ... 1

Use this attribute to activate the Z-bits on the SHDSL link.

If you activate 1 Z-bit on the SHDSL link, then the bandwidth increases with approximately 2250 bps. This additional bandwidth can then be used for e.g. a low speed PVC (refer to telindus1431Router/wanInterface/atm/lowSpeedPvc on page 416). You could use this low speed PVC, for example, to carry management data across your network (for instance, when using CES at 2 or 4 Mbps).

telindus1431Router/wanInterface/line/testDuration

Default:00000d 00h 03m 00s
Range: 00000d 00h 00m 00s - 00000d 18h 12m 15s

Use this attribute to limit the duration of active tests on the line of the Telindus 1431 SHDSL CPE.

It is possible to perform diagnostic tests on the Telindus 1431 SHDSL CPE. However, these tests cause an interruption of the normal data transfer. Some tests even cause a contact loss between the management system and the device. Therefore, tests are terminated automatically after a time-out period which you can specify using the testDuration attribute.

If you enter 00000d 00h 00m 00s as value of the testDuration attribute, then the time-out period is disabled. It means that an active test is *not* terminated automatically.

The diagnostic tests of the Telindus 1431 SHDSL CPE are:

- telindus1431Router/wanInterface/line/testActivation on page 615
- telindus1431Router/<modularIf>/testActivation on page 625

telindus1431Router/wanInterface/line/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the line object, refer to 17.6 - SHDSL line alarms on page 763.

telindus1431Router/wanInterface/line/linePair[ ]/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the linePair[ ] object, refer to 17.7 - SHDSL line pair alarms on page 764.

14.7 End configuration attributes

This section describes the following configuration attributes:

• telindus1431Router/wanInterface/end/<alarmConfigurationAttributes> on page 454

The end objects are not present in the containment tree by default. They are added automatically when you configure the eocHandling attribute. Refer to 5.4.3 - Controlling the standard EOC message exchange on page 74.

telindus1431Router/wanInterface/end/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the end object, refer to 17.8 - End alarms on page 766.

14.8 Modular user interface configuration attributes

This section discusses the configuration attributes of the modular user interfaces.

First it describes the configuration attributes that are common for both the G703 and serial interfaces. Then it describes the configuration attributes that specifically apply on the physical G703 interface and on the logical G703 interface, i.e. the G703 channel. Following this, it describes the configuration attributes that specifically apply on the physical serial interface (RS530, V35, V36 and X21).

The following gives an overview of this section:

- 14.8.1 - Common configuration attributes on page 456
- 14.8.2 - G703 interface configuration attributes on page 458
- 14.8.3 - G703 channel configuration attributes on page 464
- 14.8.4 - Serial interface configuration attributes on page 466

The configuration attributes of the encapsulation protocols that can be used on the modular user interfaces are explained in 14.5 - Encapsulation configuration attributes on page 404.

14.8.1 Common configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/<modularIf>/encapsulation on page 457
- telindus1431Router/<modularIf>/maxFifoQLen on page 457

Depending on which type of modular user interface is used, the name of the modular user interface object (labelled <modularIf> in the following text) can be g703/channel[g703_1], rs530, v35, v36 or x21.

telindus1431Router/<modularIf>/encapsulation

Default:frameRelay
Range: enumerated, see below

Use this attribute to select the encapsulation protocol on the modular user interface.

The encapsulation attribute has the following values: frameRelay and ces.

Select the encapsulation protocol …	in case you want to use the …
Frame Relay,	Frame Relay to ATM interworking function of the Telindus 1431 SHDSL CPE. Refer to 6 - Configuring Frame Relay to ATM interworking on page 93 for more information.
CES,	Circuit Emulation Service function of the Telindus 1431 SHDSL CPE. Refer to 7 - Configuring Circuit Emulation Service on page 117 for more information.
ATM,	ATM switch function of the Telindus 1431 SHDSL CPE. Refer to 8 - Configuring ATM switching on page 123 for more information.

telindus1431Router/<modularIf>/maxFifoQLen

Default:200
Range: 1 ... 4000

Use this attribute to set the maximum length (number of packets) of the First In First Out queue.

Refer to telindus1431Router/router/priorityPolicy[ ]/algorithm on page 528 for more information on this queue.

14.8.2 G703 interface configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/g703/name on page 459
- telindus1431Router/g703/coding on page 459
- telindus1431Router/g703/framing on page 459
- telindus1431Router/g703/clocking on page 460
- telindus1431Router/g703/crc4Insertion on page 460
- telindus1431Router/g703/aisDetection on page 461
- telindus1431Router/g703/sqThreshold on page 462
- telindus1431Router/g703/sqTime on page 462
- telindus1431Router/g703/jitterAttenuation on page 462
- telindus1431Router/g703/testDuration on page 462
- telindus1431Router/g703/<alarmConfigurationAttributes> on page 463

telindus1431Router/g703/name

Default:<empty>
Range: 1 ... 24 characters

Use this attribute to assign an administrative name to the G703 interface.

telindus1431Router/g703/coding

Default:hdb3
Range: enumerated, see below

Use this attribute to set the G703 interface encoding mode.

The coding attribute has the following values:

Value	Description
ami	Alternate Mark Inversion is selected. This is a bipolar code with no zero substitution.
hdb3	High Density Bipolar 3 is selected. This is a modified bipolar code. In case of HDB3 encoding, if more than three consecutive zeroes occur in the data they are replaced by a substitution word. This ensures a high pulse density. Therefore, data links using the HDB3 code can carry data patterns with a low 1 density. Most of the G703 applications use HDB3 encoding.

telindus1431Router/g703/framing

Default:unframed
Range: enumerated, see below

Use this attribute to select between unframed or framed mode.

The framing attribute has the following values:

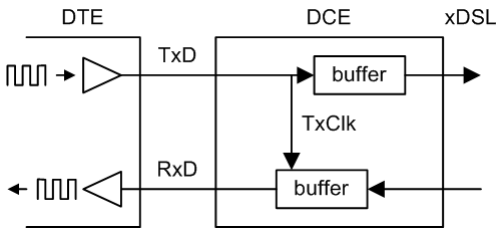
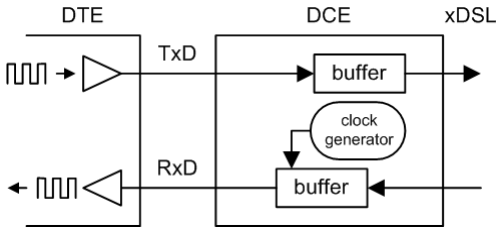
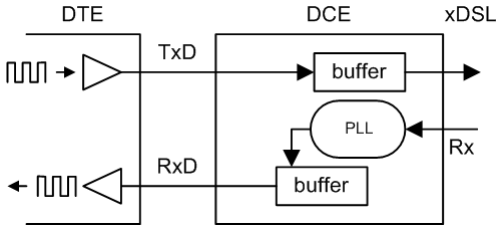
Value	Description
unframed	In unframed (transparent) mode, a 2 Mbps data stream is sent transparently over the line. In this mode, the attributes crc4Insertion and timeSlots are of no use and may be ignored.
framed	In framed (G.704 framing) mode, up to 32 time slots each containing a 64 kbps data stream can be sent over the line. Each 64 kbps time slot can be enabled or disabled individually. Refer to telindus1431Router/g703/channel[ ]/timeSlots on page 465.

telindus1431Router/g703/clocking

Default:external
Range: enumerated, see below

Use this attribute to select a clocking mode.

The clocking attribute has the following values:

Value	Description
external	The DTE (i.e. the application) delivers the clock. This clock is used to clock the receive data out and to clock the transmit data in 
internal	The DCE (i.e. the Telindus 1431 SHDSL CPE) generates the receive clock. This clock is used to clock the receive data out. The receive clock is looped by the DTE and becomes the transmit clock. This clock is used to clock the transmit data in. 
slaveOnNetwork	The receive clock is derived from the the line data. This clock is used to clock the receive data out. The receive clock is looped by the DTE and becomes the transmit clock. This clock is used to clock the transmit data in. 

Also see Important remarks on clocking on the G703 interface on page 80.

telindus1431Router/g703/crc4Insertion

Default:auto
Range: enumerated, see below

Use this attribute to determine whether the CRC-4 (Cyclic Redundancy Check) is inserted in the data or not. The CRC is used to check the data integrity on the G.703 connection.

The crc4Insertion attribute has the following values:

Value	Description
auto	In auto mode, the CRC is inserted. Additionally … • if the CRC is present in the incoming data and … - if the CRC check is successful, then everything is OK. - if the CRC check fails, then the E-bit is set. However, the LFA alarm is not raised and the errored blocks are not counted (refer to the performance attribute errBlocks on page 721). • if the CRC is not present in the incoming data, then the E-bit is set. However, the LFA alarm is not raised.
enabled	The CRC is inserted. Additionally … • if the CRC is present in the incoming data and … - if the CRC check is successful, then everything is OK. - if the CRC check fails, then the LFA alarm is raised and the errored blocks count increases (refer to the performance attribute errBlocks on page 721). • if the CRC is not present in the incoming data, then the LFA alarm is raised.
disabled	The CRC is not inserted. Additionally, possible incoming CRCs are ignored.

telindus1431Router/g703/aisDetection

Default:disabled
Range: enabled / disabled

Use this attribute to enable or disable the detection of the Alarm Indication Signal.

telindus1431Router/g703/sqThreshold

Default:10
Range: 0 ... 65535

Use this attribute to set the signal quality threshold. This is the number of erroneous seconds for which a signal quality alarm is generated.

If the sqThreshold value, i.e. the number of erroneous seconds, is exceeded within the sqTime, then a signal quality (sq) alarm is generated.

For example, if 10 (default) or more erroneous seconds occur within 1 minute (default), then a signal quality alarm is generated.

telindus1431Router/g703/sqTime

Default:00000d 00h 01m 00s
Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s

Use this attribute to set the signal quality time. This is the period (in days, hours, minutes and seconds) during which the signal quality threshold is measured.

If the sqThreshold value, i.e. the number of erroneous seconds, is exceeded within the sqTime, then a signal quality (sq) alarm is generated.

For example, if 10 (default) or more erroneous seconds occur within 1 minute (default), then a signal quality alarm is generated.

telindus1431Router/g703/jitterAttenuation

Default:32Bits
Range: enumerated, see below

Use this attribute to set the buffer depth of the jitter attenuator. The jitter attenuator of the Telindus 1431 SHDSL CPE attenuates the clock and data jitter.

The values of the jitterAttenuation attribute are 32Bits and 128Bits. You may wish to limit the buffer size to 32 bits in applications where throughput delay is critical.

telindus1431Router/g703/testDuration

Default:00000d 00h 03m 00s
Range: 00000d 00h 00m 00s - 00000d 18h 12m 15s

Use this attribute to limit the duration of active tests on the G703 interface.

It is possible to perform diagnostic tests on the G703 interface of the Telindus 1431 SHDSL CPE. However, these tests cause an interruption of the normal data transfer. Some tests even cause a contact loss between the management system and the Telindus 1431 SHDSL CPE. Therefore, tests are terminated automatically after a time-out period which you can specify using the testDuration attribute.

If you enter 00000d 00h 00m 00s as value of the testDuration attribute, then the time-out period is disabled. It means that an active test is *not* terminated automatically.

The diagnostic tests of the Telindus 1431 SHDSL CPE are:

- telindus1431Router/wanInterface/line/testActivation on page 615
- telindus1431Router/<modularIf>/testActivation on page 625

telindus1431Router/g703/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the g703 object, refer to 17.9 - G703 interface alarms on page 768.

14.8.3 G703 channel configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/g703/channel[ ]/timeSlots on page 465
- telindus1431Router/g703/channel[ ]/<alarmConfigurationAttributes> on page 465

Refer to 14.8.1 - Common configuration attributes on page 456 for an explanation of the modular user interface common configuration attributes encapsulation and maxFifoQLen.

telindus1431Router/g703/channel[ ]/timeSlots

Default:all time slots disabled
Range: bit string

Use this attribute to enable (on) or disable (off) the individual 64 kbps time slots in the framed data stream.

telindus1431Router/g703/channel[ ]/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the g703/channel[ ] object, refer to 17.10 - G703 channel alarms on page 769.

14.8.4 Serial interface configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/<serialIf>/name on page 467
- telindus1431Router/<serialIf>/transmitSampleClock on page 467
- telindus1431Router/<serialIf>/receiveSampleClock on page 467
- telindus1431Router/<serialIf>/<alarmConfigurationAttributes> on page 467

- Depending on which type of serial interface is used, the name of the serial interface object (labelled <serialIf> in the following text) can be rs530, v35, v36 or x21.
- Refer to 14.8.1 - Common configuration attributes on page 456 for an explanation of the common modular user interface configuration attributes encapsulation and maxFifoQLen.

telindus1431Router/<serialIf>/name

Default:<serialIf>
Range: 1 ... 24 characters

Use this attribute to assign an administrative name to the serial interface. By default, the name corresponds with the type of serial interface that is used, being: rs530, v35, v36 and x21.

telindus1431Router/<serialIf>/transmitSampleClock

Default:normal
Range: enumerated, see below

Use this attribute to invert the transmit sample clock.

The transmitSampleClock attribute has the following values:

Value	Description
normal	The transmit clock is normal (i.e. not inverted).
invert	The transmit clock is inverted. In case the clocking mode is set to an alternative mode, then inverting the transmit clock solves the possible problem of too long delays on the transmit data in comparison to the transmit clock.

telindus1431Router/<serialIf>/receiveSampleClock

Default:normal
Range: enumerated, see below

Use this attribute to invert the receive sample clock.

The receiveSampleClock attribute has the following values:

Value	Description
normal	The receive clock is normal (i.e. not inverted).
invert	The receive clock is inverted. In case the clocking mode is set to an alternative mode, then inverting the receive clock solves the possible problem of too long delays on the receive data in comparison to the receive clock.

telindus1431Router/<serialIf>/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the <serialIf> object (rs530, v35, v36 or x21), refer to 17.11 - Serial interface alarms on page 770.

14.9 Router configuration attributes

This section discusses the configuration attributes concerned with routing. First it describes the general routing configuration attributes. Then it explains the configuration attributes of the extra features as there are NAT, L2TP tunnelling, filtering, traffic and priority policy, etc…

The following gives an overview of this section:

- 14.9.1 - General router configuration attributes on page 469
- 14.9.2 - NAT configuration attributes on page 487
- 14.9.3 - L2TP tunnel configuration attributes on page 491
- 14.9.4 - Manual SA configuration attributes on page 499
- 14.9.5 - OSPF configuration attributes on page 503
- 14.9.6 - Routing filter configuration attributes on page 517
- 14.9.7 - Traffic policy configuration attributes on page 519
- 14.9.8 - Priority policy configuration attributes on page 527
- 14.9.9 - VRRP configuration attributes on page 532

14.9.1 General router configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/defaultRoute on page 470
- telindus1431Router/router/routingTable on page 471
- telindus1431Router/router/routingProtocol on page 472
- telindus1431Router/router/alternativeRoutes on page 472
- telindus1431Router/router/ripUpdateInterval on page 472
- telindus1431Router/router/ripHoldDownTime on page 473
- telindus1431Router/router/ripv2SecretTable on page 474
- telindus1431Router/router/sysSecret on page 475
- telindus1431Router/router/pppSecretTable on page 475
- telindus1431Router/router/helperProtocols on page 476
- telindus1431Router/router/sendTtlExceeded on page 477
- telindus1431Router/router/sendPortUnreachable on page 478
- telindus1431Router/router/sendAdminUnreachable on page 478
- telindus1431Router/router/dhcpStatic on page 479
- telindus1431Router/router/dhcpDynamic on page 481
- telindus1431Router/router/dhcpCheckAddress on page 483
- telindus1431Router/router/radius on page 484
- telindus1431Router/router/dns on page 486
- telindus1431Router/router/<alarmConfigurationAttributes> on page 486

telindus1431Router/router/defaultRoute

Default:-
Range: structure, see below

Use this attribute to set the default route, also called gateway address.

Refer to 10.3 - Configuring static routes on page 190 for more information on static routes.

The defaultRoute structure contains the following elements:

Element	Description
gateway	Use this element to specify the IP address of the next router that will route all packets for which no specific (static or dynamic) route exists in the routing table. Default:0.0.0.0 Range: up to 255.255.255.255 Whether you can omit the gateway element or not, is linked to the following conditions: **If the** interface **element specifies …** / **then …** the LAN interface, / you can not omit the gateway element. the WAN interface, / you can omit the gateway element only when using PPP encapsulation. a DLCI, PVC or tunnel, / you can omit the gateway element.
interface	Use this element to specify the interface through which the gateway can be reached. Default:<empty> Range: 0 … 24 characters Do this by typing the name of the interface as you assigned it using the configuration attribute name (e.g. telindus1431Router/lanInterface/name). Note that this interface can also be a DLCI, PVC, tunnel, etc. If you do not specify a value for the interface element, then it is deduced by checking all interfaces (including DLCIs, PVCs and tunnels) and finding an interface for which the gateway lies in the subnet defined by the IP address and net mask of that interface. Typing the string “discard”, discards all packets for the corresponding destination.
preference	Use this element to set the level of importance of the default route with respect to routes learnt via RIP. Default:10 Range: 1 … 200 RIP routes always have a preference of 60. Routes with a lower preference value are chosen over routes with higher preference value.
metric	Use this element to set with how much the metric parameter of a route has to be incremented. Default:1 Range: 1 … 15 If two routes exist with the same preference, then the route with the lowest metric value is chosen. This element is only important when combining static routes and RIP routes. Refer to 10.5.3 - Explaining the rip structure on page 207 for more information on the metric parameter.

telindus1431Router/router/routingTable

Default:<empty>
Range: table, see below

Use this attribute to configure the static IP routes.

Refer to 10.3 - Configuring static routes on page 190 for more information on static routes.

The routingTable table contains the following elements:

Element	Description
network	Use this element to specify the IP address of the destination network. Default:0.0.0.0 Range: up to 255.255.255.255
mask	Use this element to specify the network mask of the destination network. Default:255.255.255.0 Range: up to 255.255.255.255
gateway	Use this element to specify the IP address of the next router on the path to the destination network. Default:0.0.0.0 Range: up to 255.255.255.255 Whether you can omit the gateway element or not, is linked to the following conditions: **If the** interface **element specifies …** / **then …** the LAN interface, / you can not omit the gateway element. the WAN interface, / you can omit the gateway element only when using PPP encapsulation. a DLCI, PVC or tunnel, / you can omit the gateway element.
interface	Use this element to specify the interface through which the destination network can be reached. Default:<empty> Range: 0 … 24 characters Do this by typing the name of the interface as you assigned it using the configuration attribute name (e.g. telindus1431Router/lanInterface/name on page 393). Note that the “interface” can also be a DLCI, PVC, tunnel, etc. If you do not specify a value for the interface element, then it is deduced by checking all interfaces (including DLCIs, PVCs and tunnels) and finding an interface for which the gateway lies in the subnet defined by the IP address and net mask of that interface. Typing the string “discard”, discards all packets for the corresponding destination.
preference	Use this element to set the level of importance of the route. Default:10 Range: 1 … 200 Routes with a lower preference value are chosen over routes with higher preference value. Note that routes learned through RIP always have a preference of 60.
metric	Use this element to set with how much the metric parameter of a route has to be incremented. Default:1 Range: 1 … 15 If two routes exist with the same preference, then the route with the lowest metric value is chosen. Refer to 10.5.3 - Explaining the rip structure on page 207 for more information on the metric parameter.

telindus1431Router/router/routingProtocol

Default:none
Range: enumerated, see below

Use this attribute to activate or deactivate the Routing Information Protocol (RIP).

Refer to 10.5 - Configuring RIP on page 203 for more information on RIP.

The routingProtocol attribute has the following values:

Value	Description
none	No routing protocol is used. Only static routes are used.
rip	The RIP routing protocol is active. You can set the RIP version per interface. Refer to the elements txVersion and rxVersion in the rip structure (refer to 10.5.3 - Explaining the rip structure on page 207).

telindus1431Router/router/alternativeRoutes

Default:backup
Range: enumerated, see below

Use this attribute to determine how the Telindus 1431 SHDSL CPE deals with identical routes.

If more than one route to a (sub-)network is defined in the routing table, and these routes have …

- identical destination addresses, masks, preferences and metrics,
- a different gateway,

… then you can use the alternativeRoutes attribute to determine which route the Telindus 1431 SHDSL CPE uses to reach the (sub-)network.

The alternativeRoutes attribute has the following values:

Value	Description
backup	The Telindus 1431 SHDSL CPE always uses the same route to reach the (sub-)network. Only when this route goes down, it uses the alternative route.
roundRobin	The Telindus 1431 SHDSL CPE alternately uses the two possible routes to reach the (sub-)network. However, once a certain route is used to reach a specific address, this same route is always used to reach this specific address.

telindus1431Router/router/ripUpdateInterval

Default:00000d 00h 00m 30s
Range: 00000d 00h 00m 05s - 00000d 00h 10m 00s

Use this attribute to set the interval the Telindus 1431 SHDSL CPE transmits RIP update messages.

Normally, RIP update messages are transmitted every 30 seconds. It is possible to change this interval. However, changing this interval will also change the lifetime of routes learnt through RIP. If a RIP route is received for the last time, it is declared down after 6 times the ripUpdateInterval. After the route is down, it is deleted after 4 times the ripUpdateInterval.

telindus1431Router/router/ripHoldDownTime

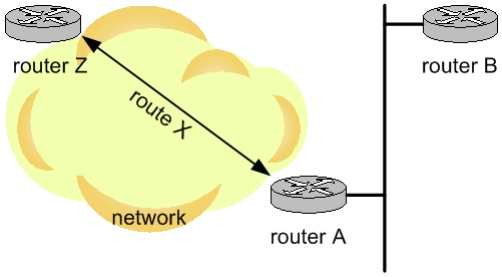
Default:00000d 00h 03m 00s
Range: 00000d 00h 00m 00s - 00000d 00h 10m 00s

Use this attribute to set the time during which routing information regarding better paths is suppressed.

It should be at least three times the value of the ripUpdateInterval attribute. A route enters into a hold-down state when an update packet is received that indicates the route is unreachable. The route is marked inaccessible and advertised as unreachable. However, the route is still used for forwarding packets. When hold-down expires, routes advertised by other sources are accepted and the route is no longer inaccessible.

What is the RIP hold-down time?

Suppose you have a situation as depicted in the figure alongside.



Now suppose the following happens:

1. Route X goes down.
   ⇒Router A sends a RIP update message to router B declaring route X down.
2. Only a few moments later, route X goes up for a while after which it goes down again. This continues for a certain time. In other words, the route status toggles between up and down.
   ⇒Every time the status of route X changes, Router A sends a RIP update message to router B. Also router B propagates these RIP update messages. In other words, the toggling of route X causes that a lot of RIP update messages are sent.

The ripHoldDownTime attribute tries to avoid situations as described above. Suppose router B has a ripHoldDownTime attribute. In that case, the situation is as follows:

1. Route X goes down.
   ⇒Router A sends a RIP update message to router B declaring route X down. Router B starts the RIP hold-down timer.
2. The status of route X starts toggling between up and down.
   ⇒Router A sends several RIP update messages concerning route X to router B. Router B holds the status of route X down, as longs as the RIP hold-down timer has not expired.

When the RIP hold-down timer expires and the route is …

- down, then the route status stays down.
- up, then the route status changes to up.

telindus1431Router/router/ripv2SecretTable

Default:<empty>
Range: table, see below

Use this attribute to define the secrets used for the RIP authentication.

Refer to 10.5.4 - Enabling RIP authentication on an interface on page 210 for more information on RIP authentication.

The ripv2SecretTable table contains the following elements:

Element	Description
keyId	Use this element to set a unique identifier for each secret. Default:0 Range: 0 ... 255
secret	Use this element to define the secret. This secret is sent with the RIP updates on the specified interface. It is also used to authenticate incoming RIP updates. Default:<empty> Range: 0 ... 16 characters
interface	Use this element to specify on which interface the secret is used. Entering the string “all” (default) means the secret is used on all the interfaces. Default:all Range: 0 ... 24 characters

Remarks

- If authentication is enabled (either text or md5), then only updates using that authentication are processed. All other updates on that interface are discarded.
- If you use md5 and if for a certain interface multiple secrets are present in the ripv2SecretTable, then the first entry in the ripv2SecretTable is used to transmit RIP updates. Authentication of the received RIP updates is done by looking for the first secret with a matching key.
- If you use text and if for a certain interface multiple secrets are present in the ripv2SecretTable, then only the first entry in the ripv2SecretTable is used to transmit and receive RIP updates.

telindus1431Router/router/sysSecret

Default:<empty>
Range: 0 ... 64 characters

Use this attribute for the PPP authentication process. The PPP authenticator uses the sysSecret attribute in order to verify the peer its response.

For more information on PPP authentication, refer to …

- 9.4.6 - Configuring PAP on page 176
- 9.4.8 - Configuring CHAP on page 179

telindus1431Router/router/pppSecretTable

Default:<empty>
Range: table, see below

Use this attribute for the PPP authentication process. Enter the authentication name and secret of the remote router in this table.

For more information on PPP authentication, refer to …

- 9.4.6 - Configuring PAP on page 176
- 9.4.8 - Configuring CHAP on page 179

The pppSecretTable contains the following elements:

Element	Description
name	Use this element to set the PPP authentication name of the remote router. Default:<empty> Range: 0 ... 64 characters If the remote router is a Telindus 1431 SHDSL CPE, then the name element should correspond with the remote Telindus 1431 SHDSL CPE its sysName or sessionName attribute. Refer to 9.4.10 - Use which name and secret attributes for PPP authentication? on page 182.
secret	Use this element to set the PPP authentication secret of the remote router. Default:<empty> Range: 0 ... 64 characters If the remote router is a Telindus 1431 SHDSL CPE, then the secret element should correspond with the remote Telindus 1431 SHDSL CPE its sysSecret or sessionSecret attribute. Refer to 9.4.10 - Use which name and secret attributes for PPP authentication? on page 182.

telindus1431Router/router/helperProtocols

Default:<empty>
Range: table, see below

Use this attribute to define the TCP and UDP port numbers for which broadcast forwarding is required. Use this attribute if you specified helper IP addresses using the helpers element in the ip structure of the LAN interface. Refer to 5.2.3 - Explaining the ip structure on page 60.

If the helperProtocols table is empty (default), then address substitution is applied for the following protocols:

Protocol name	TCP/UDP port number
Time Server	37
IEN-116 Host Name Server	42
Domain Name Server	53
TACACS database service	65
Boot Protocol (BootP) / DHCP server	68
NetBIOS Name Server	137
NetBIOS Datagram Server	138

Important remark

Specifying at least one value in the helperProtocols table clears the default helper list automatically. In that case, if you want that for instance NetBios Datagram Server broadcast is forwarded, you have to specify port number 138 again.

For BootP / DHCP broadcast packets, the Telindus 1431 SHDSL CPE is also a BootP / DHCP Relay Agent. If the protocol is selected, then the Telindus 1431 SHDSL CPE will write the IP address of its Ethernet interface in the BootP or DHCP gateway field and increment the hops field in addition to the address substitution.

telindus1431Router/router/sendTtlExceeded

Default:enabled
Range: enabled / disabled

Use this attribute to enable or disable the sending of ICMP “TTL exceeded“ messages.

The sendTtlExceeded attribute has the following values:

Value	Description
enabled	The Telindus 1431 SHDSL CPE sends ICMP “TTL exceeded" messages.
disabled	The Telindus 1431 SHDSL CPE does not send ICMP “TTL exceeded” messages. This also implies that the router is not recognised by the UNIX or Windows trace-route feature.

What is Time To Live (TTL)?

Each IP packet has a Time To Live (TTL) value in its header. Each device that sends an IP packet sets this parameter at some fixed or predefined value. When the packet enters a router, the router decrements the TTL value. If a router finds a value 0 after decrementing the TTL, it discards the packet. This because a value 0 means the packet has passed too many routers. Probably the packet is looping between a number of routers. This mechanism avoids that routers with configuration errors bring down a complete network.

The ICMP message “TTL exceeded”

If a router discards a packet because its TTL is exceeded, it normally sends an ICMP “TTL exceeded“ message to the originator of the packet. With the sendTtlExceeded attribute you can define whether you want the Telindus 1431 SHDSL CPE to send such ICMP messages or not.

It has been chosen to allow TTL exceeded messages in case of PPP. However, this has the effect that TTL exceeded is also transmitted on some Ethernet broadcasts.

telindus1431Router/router/sendPortUnreachable

Default:enabled
Range: enabled / disabled

Use this attribute to enable or disable the sending of ICMP “Destination unreachable: Port unreachable“ messages.

The sendPortUnreachable attribute has the following values:

Value	Description
enabled	The Telindus 1431 SHDSL CPE sends ICMP “port unreachable" messages.
disabled	The Telindus 1431 SHDSL CPE does not send ICMP “port unreachable” messages. This also implies that the router is not recognised by the UNIX or Windows traceroute feature.

The ICMP message “port unreachable”

The Telindus 1431 SHDSL CPE supports a number of higher-layer IP protocols (Telnet, SNMP and TMA) for management purposes. If an IP packet is sent to the Telindus 1431 SHDSL CPE for a higher-layer protocol that it does not support, it normally sends an ICMP “Destination unreachable: Port unreachable“ message to the originator of the packet. With the sendPortUnreachable attribute you can define whether you want the Telindus 1431 SHDSL CPE to send such an ICMP message or not.

telindus1431Router/router/sendAdminUnreachable

Default:enabled
Range: enabled / disabled

Use this attribute to enable or disable the sending of ICMP "Destination unreachable: Communication with destination is administratively prohibited” messages.

The sendAdminUnreachable attribute has the following values:

Value	Description
enabled	The Telindus 1431 SHDSL CPE sends ICMP “communication prohibited“ messages.
disabled	The Telindus 1431 SHDSL CPE does not send ICMP “communication prohibited“ messages.

The ICMP message “communication prohibited”

If the Telindus 1431 SHDSL CPE receives an IP packet that is destined for a prohibited destination (because this destination is defined in an access list), then it sends an ICMP "Destination unreachable: Communication with destination is administratively prohibited” message to the originator of the packet. With the sendAdminUnreachable attribute you can define whether you want the Telindus 1431 SHDSL CPE to send such an ICMP message or not.

telindus1431Router/router/dhcpStatic

Default:<empty>
Range: table, see below

This attribute activates the DHCP server on the Telindus 1431 SHDSL CPE. Use this attribute to assign a fixed IP address to a client its MAC address and this for an infinite time.

The dhcpStatic table contains the following elements:

Element	Description
ipAddress	Use this element to assign an IP address to a certain client. This client is identified with its MAC address. Default:0.0.0.0 Range: up to 255.255.255.255 If no IP address is specified, then there is no connection to the client. In that case, all other attributes in the table are ignored for this client.
mask	Use this element to set the client its subnet mask. Default:255.255.255.0 Range: up to 255.255.255.255
gateway	Use this element to set the default gateway for the client its subnet. Default:0.0.0.0 Range: up to 255.255.255.255 If the interface element is left empty (default), then it is the gateway element that determines on which interface the Telindus 1431 SHDSL CPE will act as DHCP server. Namely the interface through which the IP address as entered in the gateway element can be reached. If no gateway is specified, then the Telindus 1431 SHDSL CPE gives its own address. This address lies in the subnet of the interface through which the Telindus 1431 SHDSL CPE sends out the DHCP reply.
interface	Use this element to specify the name of the interface on which you want the Telindus 1431 SHDSL CPE to act as DHCP server. Default:<empty> Range: 0 ... 36 characters
dnsSetting	Use this element to determine which DNS servers are used for handling the DNS requests. Default:learned Range: enumerated, see below The dnsSetting element has the following values: • configured. The Telindus 1431 SHDSL CPE sends all DNS requests to the DNS servers that have been configured in the attribute telindus1431Router/router/dns on page 486. • learned. If DNS servers have been configured in the attribute telindus1431Router/router/dns, then all DNS requests are sent to these servers. However, if no DNS servers have been configured, then the Telindus 1431 SHDSL CPE tries to learn the DNS servers from the network. During the time the Telindus 1431 SHDSL CPE has not learned the DNS servers yet, DNS relay is active allowing DNS between the clients that already have been given an IP address. • relay. The Telindus 1431 SHDSL CPE acts as a DNS server for its clients, caching all DNS requests. It answers to DNS requests if possible. However, if an entry is not present in its cache, then it relays this request to the DNS servers that have been configured in the attribute telindus1431Router/router/dns.
nameServer	Use this element to set the IP address of the name server that is available to the client. Default:0.0.0.0 Range: up to 255.255.255.255

Element	Description
nameServer2	Use this element to set the IP address of the second name server that is available to the client. Default:0.0.0.0 Range: up to 255.255.255.255
tftpServer	Use this element to set the IP address of the TFTP server that is available to the client. It is the next server to use in boottrap. Default:0.0.0.0 Range: up to 255.255.255.255
macAddress	Use this element to enter the client its MAC address. Default:0.0.0.0.0.0 Range: up to ff.ff.ff.ff.ff.ff If no MAC address is specified, then there is no connection to the client. Therefore, all other attributes in the table are ignored for this client.
bootFile	Use this element to set the location of the boot file. Default:<empty> Range: 0 ... 128 characters
hostName	Use this element to set the name of the client. Default:<empty> Range: 0 ... 20 characters
domainName	Use this element to set the name the client should use when resolving hostnames via the Domain Name System (DNS). Default:<empty> Range: 0 ... 20 characters
netbiosNameServer	Use this element to set the IP address of the NetBios server. Default:0.0.0.0 Range: up to 255.255.255.255
netbiosNameServer 2	Use this element to set the IP address of the second NetBios server. Default:0.0.0.0 Range: up to 255.255.255.255
netbiosNodeType	Use this element to configure the client as described in RFC 1001 / RFC 1002. Default:<opt> Range: enumerated, see below The netbiosNodeType element has the following values: no-node, B-node, P-node, M-node, H-node.

telindus1431Router/router/dhcpDynamic

Default:<empty>
Range: table, see below

This attribute activates the DHCP server on the Telindus 1431 SHDSL CPE. Use this attribute to specify the IP address range from which an IP address may be dynamically assigned to a client its MAC address.

The dhcpDynamic table contains the following elements:

Element	Description
ipStartAddress	Use this element to define the start address of the IP address range. It is from this range that an IP address will be dynamically assigned to a client. Default:192.168.1.100 Range: up to 255.255.255.255 If no IP start address is specified, all other attributes on the same line in the table are ignored.
ipEndAddress	Use this element to define the end address of the IP address range. It is from this range that an IP address will be dynamically assigned to a client. Default:192.168.1.254 Range: up to 255.255.255.255 The IP address range will only contain the ipStartAddress in case … • no ipEndAddress is specified, • the specified ipEndAddress is the same as the ipStartAddress, • the specified ipEndAddress is smaller than the ipStartAddress, • the specified ipEndAddress belongs to another subnet than the ipStartAddress. Do not include the Telindus 1431 SHDSL CPE its own IP address in this range!
mask	Use this element to set the client its subnet mask for the specified IP address range. Default:255.255.255.0 Range: up to 255.255.255.255
gateway	Use this element to set the default gateway for the client its subnet. Default:0.0.0.0 Range: up to 255.255.255.255 If the interface element is left empty (default), then it is the gateway element that determines on which interface the Telindus 1431 SHDSL CPE will act as DHCP server. Namely the interface through which the IP address as entered in the gateway element can be reached. If no gateway is specified, then the Telindus 1431 SHDSL CPE gives its own address. This address lies in the subnet of the interface through which the Telindus 1431 SHDSL CPE sends out the DHCP reply.
interface	Use this element to specify the name of the interface on which you want the Telindus 1431 SHDSL CPE to act as DHCP server. Default:<empty> Range: 0 ... 36 characters

Element	Description
dnsSetting	Use this element to determine which DNS servers are used for handling the DNS requests. Default:learned Range: enumerated, see below The dnsSetting element has the following values: • configured. The Telindus 1431 SHDSL CPE sends all DNS requests to the DNS servers that have been configured in the attribute telindus1431Router/router/dns on page 486. • learned. If DNS servers have been configured in the attribute telindus1431Router/router/dns, then all DNS requests are sent to these servers. However, if no DNS servers have been configured, then the Telindus 1431 SHDSL CPE tries to learn the DNS servers from the network. During the time the Telindus 1431 SHDSL CPE has not learned the DNS servers yet, DNS relay is active allowing DNS between the clients that already have been given an IP address. • relay. The Telindus 1431 SHDSL CPE acts as a DNS server for its clients, caching all DNS requests. It answers to DNS requests if possible. However, if an entry is not present in its cache, then it relays this request to the DNS servers that have been configured in the attribute telindus1431Router/router/dns.
nameServer	Use this element to set the IP address of the name server that is available to the client. Default:0.0.0.0 Range: up to 255.255.255.255
nameServer2	Use this element to set the IP address of the second name server that is available to the client. Default:0.0.0.0 Range: up to 255.255.255.255
tftpServer	Use this element to set the IP address of the TFTP server that is available to the client. It is the next server to use in boottrap. Default:0.0.0.0 Range: up to 255.255.255.255
leaseTime	Use this element to set the maximum time a client can lease an IP address from the specified IP address range. Default:00000d 00h 00m 00s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s If 00000d 00h 00m 00s (default) is specified, then the lease time is infinite.
holdTime	Use this element to set the time between two consecutive leases of an IP address. I.e. if a client has just let go of its dynamically assigned IP address, then this same IP address can not be reassigned before the holdTime has elapsed. Default:00000d 00h 00m 00s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s
bootFile	Use this element to set the location of the boot file. Default:<empty> Range: 0 ... 128 characters
hostName	Use this element to set the name of the client. Default:<empty> Range: 0 ... 20 characters Because the DHCP server can not give the same name to all clients of this IP address range, a number is added to the hostname from the second IP address onwards. The number goes up to 99. **Example** Suppose the hostname is Telindus. In that case the name for the start IP address is Telindus, for the second IP address Telindus1, and so on.

Element	Description
domainName	Use this element to set the name the client should use when resolving hostnames via the Domain Name System (DNS). Default:<empty> Range: 0 ... 20 characters
netbiosNameServer	Use this element to set the IP address of the NetBios server. Default:0.0.0.0 Range: up to 255.255.255.255
netbiosNameServer 2	Use this element to set the IP address of the second NetBios server. Default:0.0.0.0 Range: up to 255.255.255.255
netbiosNodeType	Use this element to configure the client as described in RFC 1001 / RFC 1002. Default:<opt> Range: enumerated, see below The netbiosNodeType element has the following values: no-node, B-node, P-node, M-node, H-node.

telindus1431Router/router/dhcpCheckAddress

Default:disabled
Range: enumerated, see below

Use this attribute to allow that the IP address assigned by the DHCP server is probed with an ARP request (Ethernet) or ICMP Echo Request (IP). This checks and prevents the double use of IP addresses.

The dhcpCheckAddress attribute has the following values:

Value	Description
disabled	No probing is done when an IP address is leased by a client.
enabled	Probing is done when an IP address is leased by a client. In case of … • Ethernet, the probing is done with an ARP request. • IP, the probing is done with an ICMP Echo Request (ping). If a reply is received, it means the IP address is already in use. Therefore, another IP address is assigned.
arpOnly	Probing is done when an IP address is leased by a client. However, the probing is only done by means of an ARP request (Ethernet).

telindus1431Router/router/radius

Default:-
Range: structure, see below

Use this attribute to configure the Telindus 1431 SHDSL CPE for RADIUS. Also see 12.6 - Configuring RADIUS on page 332.

To enable the use of RADIUS in PPP, PAP or CHAP should be enabled on the Telindus 1431 SHDSL CPE. The local configuration of the username and password is ignored if a table of RADIUS servers exist. Furthermore, remote IP address and remote netmask are ignored if a RADIUS server imposes these attributes.

The radius structure contains the following elements:

Element	Description
authServers	Use this element to select an authentication server. You can create a list of several authentication servers. Default:<empty> Range: table, see below The authServers table contains the following elements: • address. Use this element to specify the IP address of the authentication server. Default:0.0.0.0 Range: up to 255.255.255.255 • secret. Use this element to set the shared secret to authenticate the transaction with the authentication server. Default:<empty> Range: 0 ... 64 characters • timeOut. Use this element to specify the authentication time-out. Default:00000d 00h 00m 05s Range: 00000d 00h 00m 01s - 00000d 00h 00m 10s
acctServer	Use this element to select an accounting server. You can only select one accounting server. Default:- Range: structure, see below The acctServer structure contains the following elements: • address. Use this element to specify the IP address of the accounting server. Default:0.0.0.0 Range: up to 255.255.255.255 • secret. Use this element to set the shared secret to authenticate the transaction with the accounting server. Default:<empty> Range: 0 ... 64 characters • timeOut. Use this element to specify the accounting time-out. Default:00000d 00h 00m 05s Range: 00000d 00h 00m 01s - 00000d 00h 00m 10s
retries	Use this element to specify the number of retries before selecting the next authentication server in the authServers table. Default:1 Range: 0 ... 10
acctUpdate	Use this element to specify the time at which an update of the accounting data should be send to the server. Default:00000d 00h 00m 00s Range: 00000d 00h 00m 00s - 00000d 00h 01m 00s Set this element to 0 (default) if no update is required. Note that this is not always supported by the accounting server.

Element	Description
login	Use this element to set the authentication of access to the Telindus 1431 SHDSL CPE using Telnet, FTP, TFTP or TMA. No accounting data is sent to the server. Default:disabled Range: enumerated, see below The login element has the following values: • disabled. No RADIUS login authentication is done. • enabled. Login authentication is always done using a RADIUS server. The username and password have to be entered as follows: "username:password". If the ':' is omitted, then the string is considered to be a password. Multiple passwords can be added using the same username. Access rights are sent using the RADIUS attribute CLASS (25) encoded as a string carrying a binary value. The bit definitions are: - readAccess = 00000001B - writeAccess = 00000010B - securityAccess = 00000100B - countryAccess = 00001000B (only used on aster4/5) - fileAccess = 00010000B Caution should be taken since *all* access to the device has to be authenticated by a RADIUS server. • fallback. Login authentication is done using a RADIUS server. However, if the server is not available, then authentication is done using the local security table of the device.
ppp	Use this element to set the authentication of a PPP connection that uses PAP or CHAP. Default:enabled Range: enumerated, see below The ppp element has the following values: • disabled. PPP authentication is done using the local sysName/sysSecret or sessionName/sessionSecret of the device. • enabled. PPP authentication is always done using a RADIUS server.

telindus1431Router/router/dns

Default:-
Range: structure, see below

Use this attribute to enter the DNS server addresses. Also see What is DNS? on page 776.

The dns structure contains the following elements:

Element	Description	
primaryDns	Use this element to specify the IP address of the primary DNS server.	Default:0.0.0.0 Range: up to 255.255.255.255
secondaryDns	Use this element to specify the IP address of the secondary DNS server.	Default:0.0.0.0 Range: up to 255.255.255.255
domainName	Use this element to enter the domain name to which the Telindus 1431 SHDSL CPE belongs.	Default:<empty> Range: 0 ... 32 characters

What is DNS?

The Domain Name Service (DNS) is an Internet service that translates domain names into IP addresses. Because domain names are alphabetic, they are easier to remember. The Internet however, is really based on IP addresses. Therefore, every time you use a domain name, a DNS service must translate the name into the corresponding IP address. For example, the domain name www.mywebsite.com might translate to 198.105.232.4.

The DNS system is, in fact, its own network. If one DNS server doesn't know how to translate a particular domain name, it asks another one, and so on, until the correct IP address is returned.

What is DNS proxy?

The Telindus 1431 SHDSL CPE is a DNS proxy. This means that if the Telindus 1431 SHDSL CPE has not received a DNS address (as DHCP client), then it gives its own address in DHCP requests (as DHCP server). The Telindus 1431 SHDSL CPE relays DNS requests it receives to configured or learned DNS servers.

telindus1431Router/router/<alarmConfigurationAttributes>

For more information on …

- the alarm configuration attributes alarmMask and alarmLevel and on the alarms in general, refer to 17.2 - Introducing the alarm attributes on page 756.
- the alarms of the router object, refer to 17.12 - Router alarms on page 771.

14.9.2 NAT configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/defaultNat/patAddress on page 488
- telindus1431Router/router/defaultNat/portTranslations on page 488
- telindus1431Router/router/defaultNat/servicesAvailable on page 489
- telindus1431Router/router/defaultNat/addresses on page 489
- telindus1431Router/router/defaultNat/gateway on page 490
- telindus1431Router/router/defaultNat/tcpSocketTimeOut on page 490
- telindus1431Router/router/defaultNat/udpSocketTimeOut on page 490
- telindus1431Router/router/defaultNat/tcpSockets on page 490
- telindus1431Router/router/defaultNat/udpSockets on page 490
- telindus1431Router/router/defaultNat/dmzHost on page 490

telindus1431Router/router/defaultNat/patAddress

Default:0.0.0.0
Range: up to 255.255.255.255

Use this attribute to enter the official IP address that has to be used for the Port Address Translation. Entering an address different from the default value 0.0.0.0 automatically enables PAT.

Refer to 10.7 - Configuring address translation on page 220 for more information on PAT.

telindus1431Router/router/defaultNat/portTranslations

Default:<empty>
Range: table, see below

Use this attribute to define specific port number ranges that should not be translated.

Some TCP or UDP applications do not allow port translations: these applications require a dedicated source port number. In the portTranslations table you can define UDP and TCP port ranges that should not be translated. If a packet with a source port number in such a range is received, PAT replaces only the source IP address provided it is the first device using this port number. When other devices using the same application (hence the same port number) try to send traffic to the same Internet destination address, PAT discards this traffic.

It is also possible to define port ranges that PAT should always discard. The port translation range PAT uses goes from 60928 up to 65535.

The portTranslations table contains the following elements:

Element	Description
protocol	Use this element to select the protocol: tcp or udp. Default:tcp Range: tcp / udp
startPort	Use this element to set the lowest value of the TCP or UDP port range. Default:0 Range: 0 ... 65535
endPort	Use this element to set the highest value of the TCP or UDP port range. Default:<opt> Range: 0 ... 65535 If no endPort value is defined (<opt>), then the port range is limited to the startPort value only.
action	Use this element to set the action in case a packet is received with a source port number that falls within the specified port range. Default:noTranslation Range: enumerated, see below The action element has the following values: • noTranslation. The port numbers that fall within the specified port range are not translated. • deny. Packets with port numbers that fall within the specified port range are discarded.

telindus1431Router/router/defaultNat/servicesAvailable

Default:<empty>
Range: table, see below

Use this attribute to define specific port number ranges for incoming Internet traffic that should not be translated. Instead it is sent to the corresponding private IP address.

The servicesAvailable table makes it possible to have a server on the local network that can be accessed from the Internet, although it has no official IP address.

The servicesAvailable table contains the following elements:

Element	Description
protocol	Use this element to select the protocol: tcp or udp. Default:tcp Range: tcp / udp
startPort	Use this element to set the lowest value of the TCP or UDP port range. Default:0 Range: 0 ... 65535
endPort	Use this element to set the highest value of the TCP or UDP port range. Default:<opt> Range: 0 ... 65535 If no endPort value is defined (<opt>), then the port range is limited to the startPort value only.
serverAddress	Use this element to set the private server address. Default:0.0.0.0 Range: up to 255.255.255.255 If a packet is received with a source port number that falls within the specified port range, then it is sent to the private server address.

telindus1431Router/router/defaultNat/addresses

Default:<empty>
Range: table, see below

Use this attribute to enter all the official IP addresses that have to be used for Network Address Translation. Entering an address in the addresses table automatically enables the general NAT process. Now you can activate or deactivate NAT per IP interface. Note that by default NAT is deactivated on all IP interfaces.

Refer to 10.7 - Configuring address translation on page 220 for more information on NAT.

The addresses table contains the following elements:

Element	Description
officialAddress	Use this element to set the official IP address. Default:0.0.0.0 Range: up to 255.255.255.255 These addresses are used in the reverse order as they appear in the list.
privateAddress	Use this element to set the private IP address, i.e. to permanently assign an official IP address to a private address. Default:<opt> Range: up to 255.255.255.255 If you do not specify a private IP address, then NAT is applied dynamically. I.e. the official IP address is used for any private source IP address.

telindus1431Router/router/defaultNat/gateway

Default:0.0.0.0
Range: up to 255.255.255.255

Use this attribute to define the gateway addresses of routes on which NAT or PAT should be applied. If you do not configure the gateway attribute, then NAT or PAT is applied on all routes through this interface.

telindus1431Router/router/defaultNat/tcpSocketTimeOut

Default:00001d 00h 00m 00s
Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s

Use this attribute to define the time-out for TCP sessions that are not closed by the application.

Such sessions, whether PAT or NAT is in use, remain active for one day by default. Only decrease this attribute if some TCP applications do not close properly, filling up the available translation sessions.

telindus1431Router/router/defaultNat/udpSocketTimeOut

Default:00000d 00h 03m 00s
Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s

Use this attribute to define the time-out for UDP sessions that are not closed by the application.

Such sessions, whether PAT or NAT is in use, remain active for 3 minutes by default. Only decrease this attribute if some UDP applications do not close properly, filling up the available translation sessions.

telindus1431Router/router/defaultNat/tcpSockets

Default:1024
Range: 500 ... 4500

Use this attribute to set the maximum number of TCP session that may be used simultaneously for address translation.

telindus1431Router/router/defaultNat/udpSockets

Default:1024
Range: 500 ... 4500

Use this attribute to set the maximum number of UDP session that may be used simultaneously for address translation.

telindus1431Router/router/defaultNat/dmzHost

Default:0.0.0.0
Range: up to 255.255.255.255

Use this attribute to set the address of the DMZ (demilitarised zone) host.

What is a DMZ?

In computer networks, a DMZ (demilitarised zone) is a computer host or small network inserted as a "neutral zone" between a company's private network and the outside public network. It prevents outside users from getting direct access to a server that has company data. A DMZ is an optional and more secure approach to a firewall and effectively acts as a proxy server as well.

In a typical DMZ configuration for a small company, a separate computer receives requests from users within the private network for access to Web sites or other companies accessible on the public network. The DMZ host then initiates sessions for these requests on the public network. However, the DMZ host is not able to initiate a session back into the private network. It can only forward packets that have already been requested.

Users of the public network outside the company can access only the DMZ host. The DMZ may typically also have the company's Web pages so these could be served to the outside world. However, the DMZ provides access to no other company data. In the event that an outside user penetrated the DMZ host's security, the Web pages might be corrupted but no other company information would be exposed.

14.9.3 L2TP tunnel configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/tunnels/l2tpTunnels on page 492
- telindus1431Router/router/tunnels/ipsecL2tpTunnels on page 497

telindus1431Router/router/tunnels/l2tpTunnels

Default:<empty>
Range: table, see below

Use this attribute to configure the Layer 2 Tunnelling Protocol tunnels you want to set up. Add a row to the l2tpTunnels table for each L2TP tunnel you want to set up.

The l2tpTunnels table contains the following elements:

Element	Description
name	Use this element to assign an administrative name to the tunnel. Default:<empty> Range: 0 ... 24 characters
adminStatus	Use this element to activate (up) or deactivate the tunnel (down). Default:down Range: up / down
mode	Use this element to determine whether for the corresponding tunnel, IP packets are treated by the routing process, the bridging process or both. Default:routing Range: enumerated, see below The mode element has the following values: • bridging. All packets received on the tunnel are bridged. • routing. All packets received on the tunnel are routed. • routingAndBridging. The SNAP header is checked to determine whether the packets have to be bridged or routed.
ip	Use this element to configure the IP related parameters of the tunnel. Default:- Range: structure, see below Refer to … • 5.2 - Configuring IP addresses on page 57 for general information on configuring IP addresses. • 5.2.3 - Explaining the ip structure on page 60 for a detailed description of the ip structure.
bridging	Use this element to configure the bridging related parameters of the tunnel. Default:- Range: structure, see below When bridging is enabled on a tunnel interface, the tunnel acts exactly as a bridge port for a physical PPP connection. Refer to … • 11 - Configuring bridging on page 261 for more information on bridging. • 11.2.6 - Explaining the bridging structure on page 279 for a detailed description of the bridging structure.
l2tp	Use this element to configure the L2TP related parameters of the tunnel. Default:- Range: structure, see below Refer to telindus1431Router/router/tunnels/l2tpTunnels/l2tp on page 493 for a detailed description of the l2tp structure.
backup	Use this element to configure the back-up related parameters of the tunnel. Default:- Range: structure, see below Refer to telindus1431Router/router/tunnels/l2tpTunnels/backup on page 496 for a detailed description of the backup structure.

telindus1431Router/router/tunnels/l2tpTunnels/l2tp

Default:-
Range: structure, see below

Use the l2tp structure in the l2tpTunnels table to configure the L2TP related parameters of the tunnel.

The l2tp structure contains the following elements:

Element	Description
localIpAddress	Use this element to set the official IP address that serves as start point of the L2TP connection. Default:<opt> Range: up to 255.255.255.255
remoteIpAddress	Use this element to set the official IP address that serves as end point of the L2TP connection. Default:<opt> Range: up to 255.255.255.255 Both localIpAddress and remoteIpAddress together with the well-known port number for L2TP (i.e. 1701), make up the socket used for the L2TP session. At the moment, only one L2TP session can exist between one localIpAddress and remoteIpAddress combination.
remoteDnsName	Instead of specifying a remoteIpAddress, you can specify the DNS name of the end point of the L2TP connection. In that case, the DNS name will be resolved to an IP address. Default:<empty> Range: 0 ... 64 characters Note that in this case, DNS has to be configured on the Telindus 1431 SHDSL CPE. Refer to telindus1431Router/router/dns on page 486.
pppAuthentication	Use this element to enable or disable authentication on the PPP link in the tunnel. Default:disabled Range: enumerated, see below Refer to telindus1431Router/wanInterface/atm/pvcTable/ppp/authentication on page 441 for more information.
pppSesionName	Use this element to set the PPP authentication name of the PPP link in the tunnel. Default:<empty> Range: 0 ... 64 characters
pppSesionSecret	Use this element to set the PPP authentication secret of the PPP link in the tunnel. Default:<empty> Range: 0 ... 64 characters
linkMonitoring	Use this element to enable or disable link monitoring on the PPP link in the tunnel and to fine-tune it. Default:- Range: structure, see below Refer to telindus1431Router/wanInterface/atm/pvcTable/ppp/linkMonitoring on page 440 for more information.

Element	Description
type	Use this element to specify the tunnel type. Default:outgoingDial Range: enumerated, see below The type element has the following values: • outgoingDial. The outgoing tunnel is not continuously open. It is opened whenever data has to be sent through the tunnel, and closed when no data is detected for a certain time. • outgoingLeasedLine. The outgoing tunnel is opened as soon as the Telindus 1431 SHDSL CPE is up, and it stays open. • incoming. The tunnel is an incoming tunnel. **Important remark** Make sure that if the type element is set to outgoingDial or outgoingLeasedLine at one end of the tunnel, that at the other end of the tunnel the type element is set to incoming.
dataChannelSequenceNumbering	Use this element to enable (on) or disable (off) sequence numbering on the data messages. These sequence numbers are used to detect lost packets and/or restore the original sequence of packets that may have been reordered during transport. Default:off Range: on / off On control messages, sequence numbering is always enabled. It is recommended that for connections where reordering or packet loss may occur, dataChannelSequenceNumbering is enabled.
keepAliveTimeOut	Use this element to set the amount of time (in seconds) the tunnel waits before it sends a keep alive message in case it receives no data. Default:30 Range: 1 ... 3600 If the tunnel does not receive incoming data during a certain time, it sends a keep alive message to the other side and waits for an acknowledgement.
noTrafficTimeOut	This element applies on dial tunnels only (i.e. for which the type element is set to outgoingDial). Default:120 Range: 1 ... 3600 Use this element to set the amount of time (in seconds) the tunnel waits before it closes in case it receives no data.
l2tpMode	Use this element to set the L2TP function of the Telindus 1431 SHDSL CPE. The l2tpMode element has the following values: • lac. The Telindus 1431 SHDSL CPE acts as an L2TP Access Concentrator. • lns. The Telindus 1431 SHDSL CPE acts as an L2TP Network Server. • auto. If both local and remote Telindus 1431 SHDSL CPE are set to auto, they mutually decide who will be the LAC and who the LNS. **Important remark** Only select auto if you use a Telindus router at both sides of the tunnel. In conjunction with routers from other vendors (e.g. Cisco), specifically select an L2TP mode (lac or lns).

Element	Description
tunnelAuthentication	Use this element to enable (on) or disable (off) tunnel authentication. Default:off Range: on / off L2TP incorporates a simple, optional, CHAP-like tunnel authentication system during control connection establishment. If the LAC or LNS wishes to authenticate the identity of the peer it is contacting or being contacted by, it sends a challenge packet. If the expected response and response received from a peer does not match, the tunnel is not opened. To participate in tunnel authentication, a single shared secret has to exist between the LAC and LNS.
tunnelSecret	Use this element to set the tunnel secret. This secret is used in the tunnel authentication in order to verify the peer its response. Default:<empty> Range: 0 ... 64 characters
copyTos	Use this element to enable (on) or disable (off) the copying of the TOS byte value from the payload its IP header to the L2TP header. Default:on Range: on / off
maxNrOfRetransmissions	Use this element to set the number of times a control message has to be retransmitted in case no acknowledgement follows, before the tunnel is closed. Default:4 Range: 0 ... 10
transmitWindowSize	Use this element to set the window size for transmitting control messages. Default:4 Range: 1 ... 30
receiveWindowSize	Use this element to set the window size for receiving control messages. Default:4 Range: 1 ... 30
udpChecksum	Use this element to enable (on) or disable (off) the UDP checksum. Default:off Range: on / off It is recommended to enable the UDP checksum on lower quality links.
calledNr	Use this element to set the called number. This element is present for compatibility with other vendors that support this feature. If you set up a tunnel between two Telindus devices, then you can leave this element empty. Default:<empty> Range: 0 ... 48 characters The called number is an indication to the receiver of a call as to what (telephone) number the caller used to reach it. It encodes the (telephone) number to be called for an outgoing call request (OCRQ) and the called number for an incoming call request (ICRQ). The called number is an ASCII string. Contact between the administrator of the LAC and the LNS may be necessary to coordinate interpretation of the value needed in this element.
speed	Use this element to make an indication of the expected speed for the tunnel in case of MLPPP. Default:64000 Range: 0 ... 2147483647 In case you use MLPPP, the Bandwidth Allocation Protocol adds or deletes PPP links from the bundle depending on the actual amount of traffic. However, somehow you have to be able to specify the normally required speed. Do this using the speed element.

telindus1431Router/router/tunnels/l2tpTunnels/backup

Default:-
Range: structure, see below

Use the backup structure in the l2tpTunnels table to configure the back-up related parameters of the tunnel.

In a main/back-up tunnel mechanism, configuring the backup element allows you to quickly set up a back-up tunnel as soon as the main tunnel goes down, instead of waiting on several time-outs before the back-up tunnel is set up. Refer to 12.4.4 - Setting up a main and back-up tunnel on page 323.

The backup structure contains the following elements:

Element	Description
interface	Use this element to enter the name of the tunnel that will act as back-up in a main/back-up mechanism. Default:<empty> Range: 0 ... 24 characters Alternatively, if the string "discard" is entered as a backup interface, then the backup functionality is executed for the main tunnel even if no backup tunnel is present. So the main tunnel is reset and the route to the main tunnel is closed (so the route status goes “down” instead of “spoofing”). In that case, if an alternative route is present, then this route will be taken.
timeOut	Use this element to set the set-up time-out in seconds. If the tunnel is not set up within the specified time-out, then the back-up tunnel is set up. Default:30 Range: 1 ... 3600
autoRetry	This element is only relevant in case the type element of the tunnel is set to outgoingLeasedLine. Default:no Range: yes / no Use this element to determine, if a leased line tunnel does not come up, whether it has to keep trying to come up (yes) or quit after one try (no).

telindus1431Router/router/tunnels/ipsecL2tpTunnels

Default:<empty>
Range: table, see below

Use this attribute to configure the IP secured Layer 2 Tunnelling Protocol tunnels you want to set up. Add a row to the IpsecL2tpTunnels table for each IPSEC L2TP tunnel you want to set up.

The elements of the ipsecL2tpTunnel are basically the same as the elements of the l2tpTunnel (refer to telindus1431Router/router/tunnels/l2tpTunnels on page 492). The only difference is the presence of the ipsec element within the l2tp structure. Refer to telindus1431Router/router/tunnels/ipsecL2tpTunnels/l2tp/ipsec on page 497 for more information on the ipsec element.

telindus1431Router/router/tunnels/ipsecL2tpTunnels/l2tp/ipsec

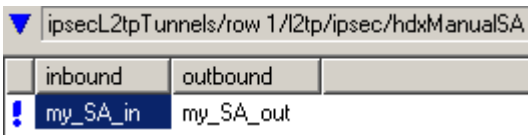
Default:-
Range: choice, see below

Use this element to apply a security association on the IPSEC L2TP tunnel.

Do this by typing the index name of the security association you want to use. You can create the security association itself by adding a manualSA or ikeSA object and by configuring the attributes in this object. Refer to 12.5 - Configuring IP security on page 326 for more information on IP security.

The ipsec element offers you the following choice:

Choice	Description
fdxManualSA	Select this value if you want to apply a manual security association on both the inbound and outbound traffic of the IPSEC L2TP tunnel. Default:<empty> Range: 0 ... 24 characters If you select this value, then a field appears behind the value. Type the manualSA object its index name in this field. **Example** If you created a manualSA object with index name my_SA (i.e. manualSA[my_SA]) and you want to apply this security association on an IPSEC L2TP tunnel, then enter the index name as value of the ipsec element.

Choice	Description
hdxManualSA	Select this value if you want to apply a manual security association on the inbound traffic and another manual security association on the outbound traffic of the IPSEC L2TP tunnel. Default:- Range: structure, see below If you select this value, then a structure appears behind the value. This structure contains the following elements: • inbound. To apply a security association on the inbound traffic, type the manualSA object its index name in this field. Default:<empty> Range: 0 ... 24 characters • outbound. To apply a security association on the outbound traffic, type the manualSA object its index name in this field. Default:<empty> Range: 0 ... 24 characters **Example** If you created a manualSA object with index name my_SA_in (i.e. manualSA[my_SA_in]) and one with index name my_SA_out (i.e. manualSA[my_SA_out]) and you want to apply the first on the inbound and the latter on the outbound traffic, then enter the index names of the manualSA objects as follows: 

14.9.4 Manual SA configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/manualSA[ ]/espEncryptionAlgorithm on page 500
- telindus1431Router/router/manualSA[ ]/espEncryptionKey on page 501
- telindus1431Router/router/manualSA[ ]/espAuthenticationAlgorithm on page 502
- telindus1431Router/router/manualSA[ ]/espAuthenticationKey on page 502
- telindus1431Router/router/manualSA[ ]/spi on page 502

This object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

telindus1431Router/router/manualSA[ ]/espEncryptionAlgorithm

Default:des
Range: enumerated, see below

Use this attribute to select the algorithm that will be used to encrypt the data when using IPSEC.

The espEncryptionAlgorithm attribute has the following values:

Value	Description
null	No encryption is done. The null encryption algorithm is simply a convenient way to represent the optional use of applying encryption within ESP. ESP can then be used to provide authentication and integrity without confidentiality.
des	DES is used to encrypt / decrypt the data. The DES key has to be entered in the espEncryptionKey attribute.
3des	Triple DES is used to encrypt / decrypt the data. The 3DES key has to be entered in the espEncryptionKey attribute.

Make sure that for the same security association on both the local and remote router the same ESP encryption algorithm is selected.

telindus1431Router/router/manualSA[ ]/espEncryptionKey

Default:<empty>
Range: octet string, 0 ... 24

Use this attribute to define the key that will be used in the encryption / decryption process when using IPSEC.

The algorithm can be selected using the espEncryptionAlgorithm attribute.

If you use …	then …
null encryption	the setting of the espEncryptionKey attribute is irrelevant.
DES encryption	only the first 8 octets of the key are used. All other octets are ignored. 11 11 11 11 11 11 11 11 22 22 22 22 22 22 22 22 33 33 33 33 33 33 33 33 used in the encryption / decryption process not used in the encryption / decryption process
3DES encryption	at the transmitter side, the first set of 8 octets of the key are used to encrypt the data, the second set of 8 octets to decrypt the data and the third set of 8 octets to encrypt the data again. 11 11 11 11 11 11 11 11 22 22 22 22 22 22 22 22 33 33 33 33 33 33 33 33 encryption decryption encryption At the receiver side, the opposite occurs.

Make sure that for the same security association on both the local and remote router the same ESP encryption key is used.

telindus1431Router/router/manualSA[ ]/espAuthenticationAlgorithm

Default:hmac_md5
Range: enumerated, see below

Use this attribute to select the algorithm that will be used to authenticate the data when using IPSEC.

The espAuthenticationAlgorithm attribute has the following values:

Value	Description
null	No authentication is done.
hmac_md5	The MD5 hash function is used to authenticate the data. The MD5 key has to be entered in the espAuthenticationKey attribute.
hmac_sha-1	The SHA-1 hash function is used to authenticate the data. The SHA-1 key has to be entered in the espAuthenticationKey attribute.

Make sure that for the same security association on both the local and remote router the same ESP authentication algorithm is selected.

telindus1431Router/router/manualSA[ ]/espAuthenticationKey

Default:<empty>
Range: octet string, 0 ... 20

Use this attribute to define the key that will be used in the authentication process when using IPSEC. The algorithm can be selected using the espAuthenticationAlgorithm attribute.

If you use …	then …
null authentication	the setting of the espAuthenticationKey attribute is irrelevant.
MD5 authentication	only the first 16 octets of the key are used. All other octets are ignored. 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 used in the authentication process not used in the authentication process
SHA-1 authentication	all 20 octets of the key are used.

Make sure that on both the local and remote router the same ESP authentication key is used.

telindus1431Router/router/manualSA[ ]/spi

Default:256
Range: 256 ... 2147483647

Use this attribute to set the SPI value. Each security association must have a unique SPI value because this value is used to identify the security association.

Make sure that for the same security association on both the local and remote router the same SPI value is used.

14.9.5 OSPF configuration attributes

This section discusses the configuration attributes concerned with OSPF. First it describes the general OSPF configuration attributes. Then it explains the OSPF area configuration attributes.

The following gives an overview of this section:

- General OSPF configuration attributes on page 504
- Area configuration attributes on page 508

General OSPF configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/ospf/routerId on page 505
- telindus1431Router/router/ospf/refBandwidth on page 505
- telindus1431Router/router/ospf/keyChains on page 505
- telindus1431Router/router/ospf/importMetrics on page 506
- telindus1431Router/router/ospf/importFilter on page 507

telindus1431Router/router/ospf/routerId

Default:0.0.0.0
Range: up to 255.255.255.255

Use this attribute to set the unique sequence number for the router in the OSPF network.

telindus1431Router/router/ospf/refBandwidth

Default:100000 bps
Range: 0 ... 2147483647

Use this attribute to set the reference bandwidth. It is used to calculate the cost of an interface in OSPF. Refer to 10.6.1 - Introducing OSPF on page 212 for more information about cost.

telindus1431Router/router/ospf/keyChains

Default:<empty>
Range: table, see below

Use this attribute to set the key chains that will be used in the MD-5 authentication process. For more information on authentication, refer to …

- 10.6.3 - Enabling OSPF authentication on page 218
- telindus1431Router/router/ospf/area[ ]/networks/authentication on page 513
- telindus1431Router/router/ospf/area[ ]/virtualLinks/authentication on page 515

The keyChains table contains the following elements:

Element	Description
name	Use this element to assign an administrative name to the key chain. Default:chain Range: 0 ... 24 characters
chain	Use this element to set the properties of each key chain. Default:<empty> Range: table, see below Refer to telindus1431Router/router/ospf/keyChains/chain on page 506 for a detailed description of this element.

telindus1431Router/router/ospf/keyChains/chain

Default:<empty>
Range: table, see below

The chain table contains the following elements:

Element	Description	
keyId	Use this element to set a unique identifier for each secret.	Default:0 Range: 0 ... 255
secret	Use this element to define the secret.	Default:<empty> Range: 0 ... 16 characters
sendDate	Use this element to set the start date from which the secret is allowed to be sent. Enter the date as argument value in the format dd/mm/yy (e.g. 01/01/05)	Default:01/01/01 Range: 01/01/01 ... 31/12/99
sendTime	Use this element to set the time from which the secret is allowed to be sent. Enter the time as argument value in the format hh:mm:ss (e.g. 12:30:45).	Default:00:00:00 Range: 00:00:00 ... 23:59:59
sendDuration	Use this element to set the period of time during which the secret is allowed to be sent.	Default:00000d 00h 00m 00s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s
acceptDate	Use this element to set the start date from which the secret is allowed to be accepted by the other routers in the OSPF network. Enter the date as argument value in the format dd/mm/yy (e.g. 01/01/05)	Default:01/01/01 Range: 01/01/01 ... 31/12/99
acceptTime	Use this element to set the time from which the secret is allowed to be accepted by the other routers in the OSPF network. Enter the time as argument value in the format hh:mm:ss (e.g. 12:30:45).	Default:00:00:00 Range: 00:00:00 ... 23:59:59
acceptDuration	Use this element to set the period of time during which the secret is allowed to be accepted by the other routers in the OSPF network. Enter this value in seconds.	Default:00000d 00h 00m 00s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s

telindus1431Router/router/ospf/importMetrics

Default:-
Range: structure, see below

Use this attribute to configure the default cost for importing RIP and static routes into OSPF.

The importMetrics structure contains following elements:

Element	Description	
static	Use this element to set the default cost of a static route which will be imported into OSPF.	Default:20 Range: 0 ... 2147483647
rip	Use this element to set the default cost of a RIP route which will be imported into OSPF.	Default:20 Range: 0 ... 2147483647

telindus1431Router/router/ospf/importFilter

Default:<empty>
Range: table, see below

Use this attribute to configure the import filter which allows or denies the import of external routes into OSPF.

The importFilter table contains following elements:

Element	Description
type	Use this element to select the type of routes which will be allowed or denied into OSPF. Default:all Range: static / rip / all Whether a route is allowed into OSPF or denied access to OSPF, is set by the element mode which is described further on in this table. The type element has the following values: • all. All routes are allowed into OSPF / denied access to OSPF. • static. Static routes are allowed into OSPF / denied access to OSPF. • rip. Rip routes are allowed into OSPF / denied access to OSPF.
address	Use this element to set the IP address the external route has to comply to. Default:0.0.0.0 Range: up to 255.255.255.255
mask	Use this element to set the netmask the external route has to comply to. Default:0.0.0.0 Range: up to 255.255.255.255 Address and mask define the address range the external route has to comply to.
mode	Use this element to allow or deny the import of external routes into OSPF. Default:allow Range: deny / allow
costType	Use this element to set the type of cost of the external route. Default:type2 Range: type1 / type2 The costType element has the following values: • type1. The external cost is expressed in the same units as OSPF interface cost (i.e. in terms of the link state metric). • type2. The external cost is an order of magnitude larger; any type 2 cost is considered greater than the cost of any path internal to the OSPF routing domain. Use of type 2 external cost assumes that routing outside the OSPF domain is the major cost of routing a packet, and eliminates the need for conversion of external costs to internal link state costs.
cost	Use this element to set the cost of the external route. Default:0 Range: 0 ... 65535
tag	Each external route can be tagged, enabling the passing of additional information between AS boundary routers. Default:0 Range: 0 ... 2147483647

Area configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/ospf/area[ ]/areaId on page 509
- telindus1431Router/router/ospf/area[ ]/stub on page 509
- telindus1431Router/router/ospf/area[ ]/networks on page 511
- telindus1431Router/router/ospf/area[ ]/virtualLinks on page 514
- telindus1431Router/router/ospf/area[ ]/ranges on page 516

This object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

telindus1431Router/router/ospf/area[ ]/areaId

Default:0.0.0.0
Range: up to 255.255.255.255

Use this attribute to set the unique sequence number for the area. The back bone area must always be area 0.

telindus1431Router/router/ospf/area[ ]/stub

Default:-
Range: structure, see below

Use this attribute to define an area as a stub area. Refer to 10.6.1 - Introducing OSPF on page 212 for the definition of a stub area.

The stub structure contains the following elements:

Element	Description
mode	Use this element to enable or disable the area as a stub area. Default:disabled Range: enabled / disabled
defaultCost	Use this element to assign a default cost to the area. This is the cost of the default route of the area. Default:0 Range: 0 ... 2147483647
importSummaries	Use this element to enable or disable the import of summary links into the stub area. Default:enabled Range: disabled / enabled When this attribute is disabled, only the default route will be injected into the area (by the Area Border Router). When it is enabled, also the summary links are injected into the area. Refer to 10.6.1 - Introducing OSPF on page 212 for the definition of a summary link.
translatorRole	Use this element to specify whether or not the Telindus 1431 SHDSL CPE will unconditionally translate Type-7 LSAs into Type-5 LSAs. Default:candidate Range: candidate / always The translatorRole element has the following values: • always. The Telindus 1431 SHDSL CPE always translates Type-7 LSAs into Type-5 LSAs regardless of the translator state of other NSSA border routers. • candidate. The Telindus 1431 SHDSL CPE participates in the translator election process. I.e. only one NSSA border router is elected as Type-7 translator among all the NSSA border routers that were set as candidate.

Element	Description
translatorInterval	Use this element to define the length of time the Telindus 1431 SHDSL CPE, if it is an elected Type-7 translator, will continue to perform its translator duties once it has determined that its translator status has been deposed by another NSSA border router translator. Default:00000d 00h 00m 40s Range: 00000d 00h 00m 00s - 00000d 18h 12m 15s If an NSSA border router is elected as Type-7 translator among all the NSSA border routers that were set as candidate, then it will continue to perform translation duties until supplanted by a reachable NSSA border router whose Nt bit is set or whose router ID is greater. Such an event may happen when an NSSA router with translatorRole set to always regains border router status, or when a partitioned NSSA becomes whole. If an elected translator determines its services are no longer required, it continues to perform its translation duties for the additional time interval defined by the translatorInterval. This minimizes excessive flushing of translated Type-7 LSAs and provides for a more stable translator transition.

telindus1431Router/router/ospf/area[ ]/networks

Default:<empty>
Range: table, see below

Use this attribute to identify the interfaces which are part of the area.

The networks table contains following elements:

Element	Description
name	Use this element to assign an administrative name to a network. Default:<network> Range: 0 ... 24 characters
address	Use this element to specify the IP address of the network. Default:0.0.0.0 Range: up to 255.255.255.255
mask	Use this element to specify the IP address mask of the attached network (Network Mask). Default:255.255.255.0 Range: up to 255.255.255.255 Address and mask define the network address to select the interfaces that will be part of the OSPF network (with the OSPF parameters defined in this network).
cost	Use this element to specify the cost of the link. When the cost is set to 0, the actual cost is calculated automatically. Default:0 Range: 0 ... 65535 Refer to 10.6.1 - Introducing OSPF on page 212 for more information about cost.
priority	Use this element to set the priority of the link. On the basis of this element, the designated router in the network is elected. Default:0 Range: 0 ... 255 Refer to 10.6.1 - Introducing OSPF on page 212 for more information about designated routers. This element is only important for broadcast networks. It must not be set for P2P links.
helloInterval	Use this element to specify the length of time, in seconds, between the hello packets that a router sends on an OSPF interface. Default:00000d 00h 00m 30s Range: 00000d 00h 00m 00s - 00000d 18h 12m 15s OSPF requires the hello interval and dead interval to be exactly the same for all routers attached to a common network.

Element	Description
deadInterval	Use this element to specify the maximum length of time, in seconds, before the neighbours declare the OSPF router down when they stop hearing the router's Hello Packets. Default:00000d 00h 02m 00s Range: 00000d 00h 00m 00s - 24855d 3h 14m 07s
retransmitinterval	Use this element to specify the length of time, in seconds, after which an hello packet is retransmitted. Default:00000d 00h 00m 05s Range: 00000d 00h 00m 00s - 00000d 00h 4m 15s
authentication	Use this element to authenticate OSPF packets. Default:- Range: structure, see below OSPF packets can be authenticated so that routers can be part of routing domains based on predefined passwords. By default, a router uses a Null authentication which means that routing exchanges over a network are not authenticated. There are two other authentication methods: Simple Password authentication and Message Digest authentication (MD-5). Refer to telindus1431Router/router/ospf/area[ ]/networks/authentication on page 513 for a detailed description of this element.
mode	Use this element to activate or disable an interface in the OSPF network. Default:active Range: active / disabled When an interface is active it is known in the OSPF network, and will pass OSPF data through the OSPF network. When it is disabled the interface is known in the OSPF network, but OSPF data will not be passed through (e.g. if an interface is connected to the outside world using RIP, the other routers in the area will know this interface, but there is no OSPF link to the outside world).

telindus1431Router/router/ospf/area[ ]/networks/authentication

Default:-
Range: structure, see below

The authentication structure contains the following elements:

Element	Description
type	Use this element to set the type of authentication. Default:disabled Range: disabled / text/ md5 The type element has the following values: • disabled. No authentication is done. • test. This allows a password (key) to be configured per interface. Interfaces of different routers that want to exchange OSPF information will have to be configured with the same key. • md5. Message Digest authentication. This is a cryptographic authentication. A key (password) and key-id are configured on each router. The router uses an algorithm based on the OSPF packet, the key, and the key-id to generate an "authentication secret" that gets added to the packet. Unlike the simple authentication, the key is not exchanged over the wire.
text	Use this element to set the password when using text authentication. Default:- Range: 0 ... 8 characters
keyChain	Use this element to set the key chain which will be used in this network when using md5 authentication. Default:chain Range: 0 ... 24 characters

telindus1431Router/router/ospf/area[ ]/virtualLinks

Default:<empty>
Range: table, see below

Use this attribute to set up a virtual link between the current area and a remote area which is not physically connected to the backbone area.

Refer to 10.6.1 - Introducing OSPF on page 212 for more information on the back bone area.

The virtual links table contains following elements:

Element	Description
remoteId	Use this element to set the IP address of the remote router with which the virtual link is established. Default:0.0.0.0 Range: up to 255.255.255.255
helloInterval	Use this element to specify the length of time, in seconds, between the hello packets that a router sends on an OSPF interface. Default:00000d 00h 00m 30s Range: 00000d 00h 00m 00s - 00000d 18h 12m 15s
deadInterval	Use this element to specify the maximum length of time, in seconds, between the sent hello packets after which the neighbours declare the virtual link down. Default:00000d 00h 02m 00s Range: 00000d 00h 00m 00s - 24855d 3h 14m 07s
retransmitinterval	Use this element to specify the length of time, in seconds, after which an hello packet is retransmitted. Default:00000d 00h 00m 05s Range: 00000d 00h 00m 00s - 00000d 00h 4m 15s
authentication	Use this element to authenticate OSPF packets. Default:- Range: structure, see below OSPF packets can be authenticated so that routers can be part of routing domains based on predefined passwords. By default, a router uses a Null authentication which means that routing exchanges over a network are not authenticated. There are two other authentication methods: Simple Password authentication and Message Digest authentication (MD-5). Refer to telindus1431Router/router/ospf/area[ ]/virtualLinks/authentication on page 515 for more information.

telindus1431Router/router/ospf/area[ ]/virtualLinks/authentication

Default:-
Range: structure, see below

The authentication structure contains the following elements:

Element	Description
type	Use this element to set the type of authentication. Default:disabled Range: disabled / text/ md5 The type element has the following values: • disabled. No authentication is done. • test. This allows a password (key) to be configured per interface. Interfaces of different routers that want to exchange OSPF information will have to be configured with the same key. • md5. Message Digest authentication. This is a cryptographic authentication. A key (password) and key-id are configured on each router. The router uses an algorithm based on the OSPF packet, the key, and the key-id to generate an "authentication secret" that gets added to the packet. Unlike the simple authentication, the key is not exchanged over the wire.
text	Use this element to set the password when using text authentication. Default:-- Range: 0 ... 8 characters
keyChain	Use this element to set the key chain which will be used in the virtual link when using md5 authentication. Default:chain Range: 0 ... 24 characters

telindus1431Router/router/ospf/area[ ]/ranges

Default:<empty>
Range: table, see below

By defining ranges in an area, Summary-LSAs can be condensed before being injected in an other area (by defining a larger subnet mask).

Refer to 10.6.1 - Introducing OSPF on page 212 for more information about Summary-LSAs.

Each address range is defined as an address-mask pair. Many separate networks may then be contained in a single address range, just as a subnetted network is composed of many separate subnets. Area border routers then summarize the area contents (for distribution to the backbone) by advertising a single route for each address range. The cost of the route is the maximum cost to any of the networks falling in the specified range.

The ranges table contains following elements:

Element	Description
type	Use this element to set the type of Summary-LSA that has to be created. Default:all Range: enumerated, see below The type element has the following values: • summary. The area's routing information is condensed. • nssa. In case of an NNSA, multiple Type-7 LSAs are aggregated into a single Type-5 LSA. • all. Both tasks are performed.
network	Use this element to set the IP address of the network. Default:0.0.0.0 Range: up to 255.255.255.255
mask	Use this element to set the subnet mask. Default:255.255.255.0 Range: up to 255.255.255.255
advertise	Use this element to enable or disable the advertisement of the Summary-LSAs into the other areas. Default:enabled Range: enabled / disabled When this element is disabled, the Summary-LSAs which are part of this range, will not be known in the other area's in the OSPF network. When this element is enabled, the summaries are injected in the other areas of the OSPF network.
tag	This element is only relevant in case of NSSAs. Use this element to retag the summary of the external routes entering the NSSA. Default:0 Range: 0 ... 2147483647

14.9.6 Routing filter configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/routingFilter[ ]/filter on page 518

This object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

telindus1431Router/router/routingFilter[ ]/filter

Default:<empty>
Range: table, see below

Use this attribute to set up a routing update filter.

Only the routes to networks that are specified in the filter table are forwarded. All other routes are blocked. If the filter table is empty, then all routes are forwarded.

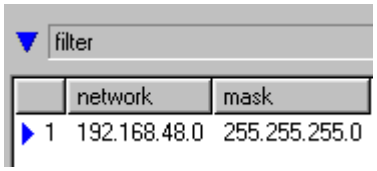
The filter table contains the following elements:

Element	Description
network	This is the IP address of the network. The address may be a (sub-)network address. It should match an entry in the telindus1431Router/router/routingTable status attribute of the Telindus 1431 SHDSL CPE. Default:0.0.0.0 Range: up to 255.255.255.255
mask	This is the IP subnet mask of the network. By combining an IP address with a mask you can uniquely identify a range of addresses. Default:255.255.255.0 Range: up to 255.255.255.255

Currently, the Telindus 1431 SHDSL CPE supports up to 5 routing update filters. Although you can add more than 5 routingFilter[ ] objects to the containment tree, no more than 5 will be active.

Example

This example shows a filter that only forwards the route to subnet 192.168.48.0.



14.9.7 Traffic policy configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/trafficPolicy[ ]/method on page 520
- telindus1431Router/router/trafficPolicy[ ]/trafficShaping on page 521
- telindus1431Router/router/trafficPolicy[ ]/dropLevels on page 524
- telindus1431Router/router/trafficPolicy[ ]/tos2QueueMapping on page 526

This object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

telindus1431Router/router/trafficPolicy[ ]/method

Default:trafficShaping
Range: enumerated, see below

Use this attribute to choose an IP traffic policy method. This IP traffic policy is then used to …

- determine, on traffic overload conditions, how and which queues are filled with the “excess” data. Refer to 10.8 - Configuring traffic and priority policy on the router on page 238.
- do policy based routing. Refer to 10.4 - Configuring policy based routing on page 198.
- filter data on an interface. Refer to 12.2 - Configuring the access restrictions on page 294.

The method attribute has the following values:

<table>
<tr><th>Value</th><th>Description</th></tr>
<tr><td>trafficShaping</td><td>The data is …
redirected to the queues based on the settings of the attribute telindus1431Router/router/trafficPolicy[ ]/trafficShaping (queuing).
redirected to an interface or a gateway based on the settings of the attribute telindus1431Router/router/trafficPolicy[ ]/trafficShaping (policy based routing).
filtered based on the settings of the attribute telindus1431Router/router/trafficPolicy[ ]/trafficShaping (extended access list).</td></tr>
<tr><td>tosDiffServ</td><td>The data is redirected to the queues based on DiffServ (refer to RFC 2597) regarding class and drop precedence. Refer to What is AF PHB? on page 241.

This means that, depending on their DSCP field in the TOS byte, some packets are moved to other queues and/or dropped sooner than other packets in case the queue is full.

The highest 3 bits of the DSCP field are mapped as follows:<table><tr><th>Bit values …</th><th>are mapped to …</th></tr><tr><td>000 up to 100</td><td>queues 1 up to 5, respectively.</td></tr><tr><td>101 and higher</td><td>the low delay queue.</td></tr></table>The next 2 bits of the DSCP field define the drop levels:<table><tr><th>Bit values …</th><th>correspond with …</th></tr><tr><td>00 and 01</td><td>dropLevel1</td></tr><tr><td>10</td><td>dropLevel2</td></tr><tr><td>11</td><td>dropLevel3</td></tr></table>Refer to the attribute telindus1431Router/router/trafficPolicy[ ]/dropLevels for more information on drop levels.</td></tr>
<tr><td>tosMapped</td><td>The data is redirected to …
the queues based on the settings of the attribute telindus1431Router/router/trafficPolicy[ ]/tos2QueueMapping (queuing).
an interface or a gateway based on the settings of the attribute telindus1431Router/router/trafficPolicy[ ]/tos2QueueMapping (policy based routing).</td></tr>
</table>

telindus1431Router/router/trafficPolicy[ ]/trafficShaping

Default:<empty>
Range: table, see below

The function of this attribute is threefold:

- **Traffic and priority policing**
  In case you have set the telindus1431Router/router/trafficPolicy[ ]/method attribute to trafficShaping, then use the trafficShaping table to specify which data has to be redirected to which queue. If an overload condition occurs, then a packet is redirected to the specified queue when the criteria as specified in the trafficShaping table are met.
  Refer to 10.8 - Configuring traffic and priority policy on the router on page 238.
- **Policy based routing**
  In case you have set the telindus1431Router/router/trafficPolicy[ ]/method attribute to trafficShaping, then use the trafficShaping table to specify which data has to be redirected to which interface or gateway. Packets are redirected to the specified interface or gateway when the criteria as specified in the trafficShaping table are met.
  Refer to 10.4 - Configuring policy based routing on page 198.
- **Extended access list**
  In case you have set the telindus1431Router/router/trafficPolicy[ ]/method attribute to trafficShaping, then use the trafficShaping table to specify which data is forwarded. Packets are forwarded when the criteria as specified in the trafficShaping table are met. If more than one entry applies to the same packet, then the entry which has the narrowest filter range (when looking at the filter criteria from left to right) is chosen.
  Refer to 12.2 - Configuring the access restrictions on page 294.

Important remarks

- By default, the entries in the trafficShaping table are “allow” rules. I.e. only the traffic defined in the table is permitted, all other traffic is discarded (independent whether the traffic shaping table is used as an access list, for priority policing or policy based routing). However, you can inverse an entry making it a “deny” rule by entering “discard” as value of the interface element.
- If more than one entry applies to the same packet, then the entry which has the narrowest filter range (when looking at the filter criteria from left to right) is chosen. For example: two rows in the trafficShaping table apply to the same packet, but row 1 wants to forward packets to queue 3 and row 2 wants to forward packets to the low delay queue. In that case, first the IP source address is considered. The row with the smallest range wins. If the ranges are exactly the same, then the IP destination address is considered. And so on. Should the two rows be completely identical except for the queue, then one of the rows is chosen at random.
- You do not necessarily have to fill in IP addresses in the trafficShaping table. It is perfectly valid to filter on IP protocol, IP protocol/port combination or TOS values only. However, you can not filter on port numbers only. What is more, you can only filter on port numbers when the IP protocol is set to TCP or UDP. So in other words, if the IP protocol element is set to a value different from TCP or UDP, then all the port elements are ignored.

The trafficShaping table contains the following elements:

Element	Description
sourceIpStart-Address sourceIpEnd-Address	Use these elements to set the IP source address as specified in the IP header. Default:0.0.0.0 Range: up to 255.255.255.255 Packets that fall within the specified range are forwarded and queued if applicable.
destinationIpStart-Address destinationIpEnd-Address	Use these elements to set the IP destination address as specified in the IP header. Default:0.0.0.0 Range: up to 255.255.255.255 Packets that fall within the specified range are forwarded and queued if applicable.
tosStartValue tosEndValue	Use these elements to set the TOS byte value. Default:any(start)/optional(end) Range: 0 ... 256 Packets that fall within the specified range are forwarded and queued if applicable.
ipProtocol	Use this element to set the protocol field from the IP header. Default:any Range: 0 ... 255 Packets that have the specified protocol field are forwarded and queued if applicable. You can specify the protocol by typing the protocol number. For ease of use, some common protocols can be selected from a drop-down box: any (0), ICMP (1), IGMP (2), IPinIP (4), TCP (6), EGP (8), IGP (9), UDP (17), RSVP (46), IGRP (88), OSPFIGP (89), TCPestablished (255).
sourcePortStart sourcePortEnd	Use these elements to set the source port as specified in the UDP / TCP headers. Default:any(start)/optional(end) Range: 0 ... 65535 Packets that fall within the specified range are forwarded and queued if applicable. You can specify the port by typing the protocol number. For ease of use, some common port numbers can be selected from a drop-down box: any or optional (0), echo (7), discard (9), ftp-data (20), ftp (21), telnet (23), smtp (25), domain (53), www-http (80), pop3 (110), nntp (119), snmp (161), snmptrap (162), z39.50 (210), syslog (514), router (520), socks (1080), l2tp (1701), telindus (1728). Note that the predefined “echo” value is a UDP port. It has nothing to do with ICMP echo.
destinationPortStart destinationPortEnd	Use these elements to set the destination port as specified in the UDP / TCP headers. Default:any(start)/optional(end) Range: 0 ... 65535 Packets that fall within the specified range are forwarded and queued if applicable. You can specify the port by typing the protocol number. For ease of use, some common port numbers can be selected from a drop-down box: see above.
newTosValue	Use this element to set the new TOS byte value. Default:unchanged Range: 0 ... 256 When you select a new TOS byte value, then a packet that matches an entry in the trafficShaping table its TOS byte value is changed. Selecting unchanged, leaves the TOS byte value as it is.

Element	Description
priority	Use this element to set the destination queue for a packet matching an entry in the trafficShaping table. Default:queue1 Range: enumerated, see below In case an overload condition occurs, then a packet that matches an entry in the trafficShaping table is sent to the specified queue. The priority element has the following values: queue1, queue2, queue3, queue4, queue5, lowDelayQueue.
interface	Use this element to set the destination interface for a packet matching an entry in the trafficShaping table. This is policy based routing. Default:<empty> Range: 0 ... 24 characters Type the name of the interface in the interface element, e.g. lan. Note that by default, the entries in the trafficShaping table are “allow” rules. I.e. only the traffic defined in the table is permitted, all other traffic is discarded (independent whether the traffic shaping table is used as an access list, for priority policing or policy based routing). However, you can inverse an entry making it a “deny” rule by entering “discard” as value of the interface element.
gateway	Use this element to set the gateway for a packet matching an entry in the trafficShaping table. This is policy based routing. Default:<opt> Range: up to 255.255.255.255

Start and end values

Except for the ipProtocol, newTosValue and priority elements, it is possible to specify ranges using the start and end values. There are two special cases:

- A start value is entered, but no end value ⇒ an exact match is needed for the start value.
- Neither a start nor an end value is entered ⇒ the field is not checked.

telindus1431Router/router/trafficPolicy[ ]/dropLevels

Default:-
Range: table, see below

Use this attribute to define for each user configurable queue, how many packets may be queued before they are dropped.

The dropLevels table contains the following elements:

Element	Description
dropLevel1	Use this element to set the maximum length (drop level 1), in packets, of each user configurable queue. Default:100 Range: 1 ... 3000 In case you set the attribute telindus1431Router/router/trafficPolicy[ ]/method to … • trafficShaping or tosMapped, then only this drop level is relevant. • tosDiffServ, then this drop level corresponds with the drop level bits value 00 and 01.
dropLevel2	Use this element to set the maximum length (drop level 2), in packets, of each user configurable queue. Default:100 Range: 1 ... 3000 In case you set the attribute telindus1431Router/router/trafficPolicy[ ]/method to … • trafficShaping or tosMapped, then this drop level is not relevant. • tosDiffServ, then this drop level corresponds with the drop level bits value 10.
dropLevel3	Use this element to set the maximum length (drop level 3), in packets, of each user configurable queue. Default:100 Range: 1 ... 3000 In case you set the attribute telindus1431Router/router/trafficPolicy[ ]/method to … • trafficShaping or tosMapped, then this drop level is not relevant. • tosDiffServ, then this drop level corresponds with the drop level bits value 11.

Examples

Suppose …

- telindus1431Router/router/trafficPolicy[ ]/method is set to trafficShaping or tosMapped.
- for queue 1 you set maxLength1 = 1000, for queue 2 to 500, for queue 3 to 3000, for queue 4 to 1000 and for queue 5 to 200.

In this case, packets are dropped when the amount of packets in the queue exceeds the amount as specified with the maxLength1 element.

Suppose …

- telindus1431Router/router/trafficPolicy[ ]/method is set to tosDiffServ.
- for queue 1 you set maxLength1 = 100, maxLength2 = 200 and maxLength3 = 50.

In this case, the following applies:

Queue 1 contains … data packets.	**An incoming data packet with … is …**		
	drop level[1] 1	**drop level 2**	**drop level 3**
less than 50	accepted	accepted	accepted
more than 50, less than 100	accepted	accepted	dropped
more than 100, less than 200	dropped	accepted	dropped
more than 200	dropped	dropped	dropped

1. As defined in the TOS byte.

telindus1431Router/router/trafficPolicy[ ]/tos2QueueMapping

Default:<empty>
Range: table, see below

- **Traffic and priority policing**
  In case you have set the telindus1431Router/router/trafficPolicy[ ]/method attribute to tosMapped, then use the tos2QueueMapping table to specify which data has to be redirected to which queue. If an overload condition occurs, then a packet is redirected to the specified queue when the criteria as specified in the tos2QueueMapping table are met.
  Refer to 10.8 - Configuring traffic and priority policy on the router on page 238 and 11.3.2 - Configuring a traffic policy on the bridge on page 285.
- **Policy based routing**
  In case you have set the telindus1431Router/router/trafficPolicy[ ]/method attribute to tosMapped, then use the tos2QueueMapping table to specify which data has to be redirected to which interface or gateway. Packets are redirected to the specified interface or gateway when the criteria as specified in the tos2QueueMapping table are met.
  Refer to 10.4 - Configuring policy based routing on page 198.

The tos2QueueMapping table contains the following elements:

Element	Description
startTos endTos	Use these elements to set the TOS byte value. Packets that have a TOS byte value within the specified range are redirected to the targetQueue. Default:0 (start) / 255 (end) Range: 0 ... 255
targetQueue	Use this element to set the destination queue. The targetQueue element has the following values: Queue1, Queue2, Queue3, Queue4, Queue5, lowDelayQueue. Default:Queue1 Range: enumerated, see below
interface	Use this element to set the destination interface for a packet matching an entry in the tos2QueueMapping table. This is policy based routing. Type the name of the interface in the interface element, e.g. lan. Default:<empty> Range: 0 ... 24 characters
gateway	Use this element to set the gateway for a packet matching an entry in the tos2QueueMapping table. This is policy based routing. Default:<opt> Range: up to 255.255.255.255

14.9.8 Priority policy configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/priorityPolicy[ ]/algorithm on page 528
- telindus1431Router/router/priorityPolicy[ ]/countingPolicy on page 530
- telindus1431Router/router/priorityPolicy[ ]/queueConfigurations on page 530
- telindus1431Router/router/priorityPolicy[ ]/lowdelayQuotum on page 530
- telindus1431Router/router/priorityPolicy[ ]/bandwidth on page 531

This object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

telindus1431Router/router/priorityPolicy[ ]/algorithm

Default:fifo
Range: enumerated, see below

Use this attribute to determine how and which queues are emptied.

The algorithm attribute has the following values:

Value	Description
fifo	This is a First In First Out queue. The data that enters the queue first, also leaves the queue first. This is the fastest but most superficial queuing mechanism. You can change the maximum length of the FIFO queue on an interface using the configuration attribute maxFifoQLen.
roundRobin	This is a priority queuing mechanism. In this case, all user configurable queues containing data have an equal weight. In other words, if all the user configurable queues contain data, they are addressed in turns. The low delay has a higher priority, it is addressed between every user configurable queue. The system queue has absolute priority, it is emptied as soon as it contains data. • Queues 1 up to 5: user configurable queues. These queues are addressed in turns. • Queue 6: low delay queue. This queue is addressed between every user configurable queue. • Queue 7: system queue. This queue has absolute priority over all other queues. As soon as it contains data, it is emptied.
absolutePriority	This is a priority queuing mechanism. In this case, queues with a high priority have *absolute* priority over queues with a low priority. In other words, no lower priority queue is emptied as long as a higher priority queue contains data. The priority of the queues runs parallel to the queue number. I.e. the user configurable queue number 1 has the lowest priority, whereas the system queue (number 7) has the highest priority. • Queues 1 up to 5: user configurable queues. Queue 1 has the lowest priority whereas queue 5 has the highest priority. A lower priority queue is only emptied in case no higher priority queue contains data. • Queue 6: low delay queue. This queue is only emptied in case the system queue contains no data. • Queue 7: system queue. This queue has absolute priority over all other queues. As soon as it contains data, it is emptied. Note that there is a risk of *starvation*. This means that it is possible that the lower priority queues are never emptied because a higher priority queue continuously receives data.

Value	Description
weightedFair-Queueing	This is a priority queuing mechanism. In this case, the user configurable queues are addressed based on their weight. The low delay has a higher priority, it is addressed between every user configurable queue. The system queue has absolute priority, it is emptied as soon as it contains data. • Queues 1 up to 5: user configurable queues. These queues are addressed based on their weight. The weight can be configured in the telindus1431Router/router/priorityPolicy[ ]/queueConfigurations attribute. • Queue 6: low delay queue. This queue is addressed between every user configurable queue. • Queue 7: system queue. This queue has absolute priority over all other queues. As soon as it contains data, it is emptied.
lowDelayWeighted-FairQueueing	This is a priority queuing mechanism. It is a combination of absolute priority and weighted fair queueing. In this case, the user configurable queues are addressed based on their weight. The low delay queue has absolute priority over all user configurable queues and the system queue has absolute priority over all queues. • Queues 1 up to 5: user configurable queues. These queues are addressed based on their weight. The weight can be configured in the telindus1431Router/router/priorityPolicy[ ]/queueConfigurations attribute. • Queue 6: low delay queue. This queue has absolute priority over all user configurable queues. If the system queue does not contain data but the low delay queue and the user configurable queues do, then it is the low delay queue that is emptied. • Queue 7: system queue. This queue has absolute priority over all other queues. As soon as it contains data, it is emptied. In a network that carries both voice and data, the lowDelayWeightedFairQueueing algorithm is the most suited mechanism to get the voice over the network with a minimum delay. In this case, the voice has to be queued in the low delay queue.

telindus1431Router/router/priorityPolicy[ ]/countingPolicy

Default:bytes
Range: enumerated, see below

Use this attribute to define whether the quotum of the queues is expressed in bytes or packets.

telindus1431Router/router/priorityPolicy[ ]/queueConfigurations

Default:<empty>
Range: table, see below

Use this attribute to …

- set the number of bytes/packets that is dequeued from the user configurable queue when the queue is addressed.
- set the relative importance of the user configurable queues.

The queueConfigurations table contains the following elements:

Element	Description
quotum	Use this element to set the number of bytes/packets that is dequeued from the user configurable queue when the queue is addressed. Default:1500 Range: 1 ... 25000 The unit of the quotum (bytes or packets) can be set with the telindus1431Router/router/priorityPolicy[ ]/countingPolicy attribute.
weight	Use this element to set the relative importance of the user configurable queues. Default:1 Range: 1 ... 10 The weight element is only relevant in case the telindus1431Router/router/priorityPolicy[ ]/algorithm attribute is set to weightedFairQueueing. **Example** Suppose queue 1 has weight 2, queue 2 has weight 1 and both queues contain data. In that case the queues are emptied in the following order: queue 1 → queue 1 → queue 2 → queue 1 → queue 1 → queue 2 → etc.

Refer to 10.8.1 - Introducing traffic and priority policy on page 239 for more information on queues.

telindus1431Router/router/priorityPolicy[ ]/lowdelayQuotum

Default:1500
Range: 1 ... 25000

Use this attribute to set the number of bytes/packets that is dequeued from the low delay queue when the queue is addressed. The unit of the quotum (bytes or packets) can be set with the telindus1431Router/router/priorityPolicy[ ]/countingPolicy attribute.

Refer to 10.8.1 - Introducing traffic and priority policy on page 239 for more information on queues.

telindus1431Router/router/priorityPolicy[ ]/bandwidth

Default:-
Range: table, see below

Use this attribute to set the bandwidth per queue.

The bandwidth table contains the following elements:

Element	Description
cir	Use this element to set the Committed Information Rate (CIR), in bits per second, of the different queues. Default:0 Range: 0 ... 2147483647 Using entry 1 up to 5 in the bandwidth table you can set the CIR for queues 1 up to 5, respectively. Using entry 6 in the bandwidth table you can set the CIR for the low delay queue. If the CIR is exceeded, then the data is first queued. The amount of data that is queued can be set using the maxFifoQLen attribute. If the queue is completely filled up, then the data is discarded.

Refer to 10.8.1 - Introducing traffic and priority policy on page 239 for more information on queues.

14.9.9 VRRP configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/router/vrrp[ ]/vrId on page 533
- telindus1431Router/router/vrrp[ ]/ipAddresses on page 533
- telindus1431Router/router/vrrp[ ]/interfaces on page 534
- telindus1431Router/router/vrrp[ ]/criticals on page 534
- telindus1431Router/router/vrrp[ ]/advertiseInterval on page 535
- telindus1431Router/router/vrrp[ ]/preemptMode on page 535

This object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

telindus1431Router/router/vrrp[ ]/vrId

Default:0
Range: 0 ... 255

Use this attribute to set the identification of the virtual router. Specify a number between 1 and 255. The VRID has to be set the same on all participating routers.

Setting the vrId to 0 (default) disables this virtual router instance.

telindus1431Router/router/vrrp[ ]/ipAddresses

Default:<empty>
Range: table, see below

Use this attribute to configure one or more IP addresses on the virtual router.

The ipAddresses table contains the following element:

Element	Description
address	Use this element to configure the IP address of the virtual router. This address must be the same on all routers participating in this virtual router. Default:0.0.0.0 Range: up to 255.255.255.255 By adding several IP addresses, several IP addresses can be configured on a single virtual router. This can be used to ensure redundancy while migrating from one address scheme to another. It cannot be used for load balancing purposes, in this case multiple virtual routers must be used. If no IP address is configured, this virtual router instance is not active.

It is important that all VRRP routers have a physical interface configured with an IP address in the same subnet as the virtual router. The VRRP protocol sends only IP addresses and not subnet information. Without the corresponding subnet information, the VRRP router will add the virtual router address as a single IP address with a host (255.255.255.255) netmask. This will prevent routing from working properly, as the virtual router will not listen to broadcasts from the local network.

telindus1431Router/router/vrrp[ ]/interfaces

Default:<empty>
Range: table, see below

Use this attribute to add Ethernet-alike interfaces[2] to the virtual router and assign a priority to them. This priority is used in the master virtual router election process.

The interfaces table contains the following element:

Element	Description
name	Use this element to specify the name of the interface that you want to add to the virtual router. Default:<empty> Range: 0 ... 36 characters
priority	Use this element to specify the priority of the interface. Specify a number between 1 and 254. The higher the number, the higher the priority. Default:100 Range: 1 ... 254 The numbers 0 and 255 are reserved numbers and cannot be set by the user: • 0 specifies that the master has stopped working and that the backup router needs to transition to master state. • 255 specifies that the VRRP router is the IP address owner and therefore is master, independently from the priority settings. Refer to 10.9.1 - Introducing VRRP on page 254 for more information on how the priority plays a role in the election of a master virtual router.

telindus1431Router/router/vrrp[ ]/criticals

Default:<empty>
Range: table, see below

Use this attribute to specify which interfaces must be up before a router may be elected as master virtual router.

The criticals table contains the following element:

Element	Description
name	Use this element to specify the name of the interface that must be up before the router may be elected as master. Default:<empty> Range: 0 ... 36 characters So as soon as an interface that is defined in the criticals table goes down, the complete router is considered to be down (on VRRP level that is). In that case, a new master has to be elected. So this adds an extra condition to the election process as shown in How is a master virtual router elected? on page 255.

2. Ethernet-alike interfaces are e.g. an Ethernet interface, a VLAN on an Ethernet interface, a bridge group, a VLAN on a bridge group, etc.

telindus1431Router/router/vrrp[ ]/advertiseInterval

Default:00000d 00h 00m 01s
Range: 00000d 00h 00m 00s - 00000d 18h 12m 15s

Use this attribute to set the time between VRRP advertisement transmissions.

Actually, only the master virtual router sends VRRP advertisements. However, the advertisement interval has to be set the same on all participating routers.

telindus1431Router/router/vrrp[ ]/preemptMode

Default:enabled
Range: enabled / disabled

Use this attribute to allow a backup virtual router to take over from the master virtual router in case the backup virtual router has a higher priority on the enclosing virtual router.

The preemptMode attribute has the following values:

Value	Description
enabled	If after a router is elected as master a backup appears which has a higher priority than the master, then the backup begins to send its own advertisements. The current master will see that the backup has higher priority and stop functioning as the master. The backup will then see that the master has stopped sending advertisements and assume the role of master.
disabled	Once a router is elected as master, it stays master until it goes down. So the appearance of a backup with a higher priority after the master has been elected does not cause a new election process.

While preemption can ensure that a primary router will return to master status once it returns to service, preemption also causes a brief outage while the election process takes place. Disabling preemption will ensure maximum up-time on the network, but will not always result in the primary or highest priority router acting as master.

Note that, regardless of the setting of the preemptMode attribute, the VRRP IP address owner will always preempt.

14.10 Bridge configuration attributes

This section discusses the configuration attributes concerned with bridging. First it describes the general bridging configuration attributes. Then it explains the configuration attributes of the extra features as there are access listing, user priority mapping, etc…

The following gives an overview of this section:

- 14.10.1 - Bridge group configuration attributes on page 537
- 14.10.2 - Bridge access list configuration attributes on page 549
- 14.10.3 - Bridge traffic policy configuration attributes on page 551

14.10.1 Bridge group configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/bridge/bridgeGroup/name on page 538
- telindus1431Router/bridge/bridgeGroup/ip on page 538
- telindus1431Router/bridge/bridgeGroup/arp on page 538
- telindus1431Router/bridge/bridgeGroup/bridgeCache on page 539
- telindus1431Router/bridge/bridgeGroup/bridgeTimeOut on page 540
- telindus1431Router/bridge/bridgeGroup/spanningTree on page 540
- telindus1431Router/bridge/bridgeGroup/localAccess on page 541
- telindus1431Router/bridge/bridgeGroup/macAddress on page 542
- telindus1431Router/bridge/bridgeGroup/vlan on page 543
- telindus1431Router/bridge/bridgeGroup/multiVlans on page 545
- telindus1431Router/bridge/bridgeGroup/vlanSwitching on page 547

telindus1431Router/bridge/bridgeGroup/name

Default:bridge
Range: 1 ... 24 characters

Use this attribute to assign an administrative name to the bridge.

This attribute is only present on the default bridge group (bridgeGroup), not on the user instantiatable bridge groups (vpnBridgeGroup[ ]). The user instantiatable bridge groups their name is the index name that you have to specify when you add the bridge group object to the containment tree (refer to 11.2.3 - Adding a bridge group on page 275).

telindus1431Router/bridge/bridgeGroup/ip

Default:<empty>
Range: structure, see below

Use this attribute to configure the IP related parameters of the bridge.

Refer to …

- 5.2 - Configuring IP addresses on page 57 for general information on configuring IP addresses.
- 5.2.3 - Explaining the ip structure on page 60 for a detailed description of the ip structure.

Important remark

If you set the configuration attribute telindus1431Router/lanInterface/mode to bridging, then the settings of the configuration attribute telindus1431Router/lanInterface/ip are ignored. As a result, if you want to manage the Telindus 1431 SHDSL CPE via IP, you have to configure an IP address in the bridgeGroup object instead: telindus1431Router/bridge/bridgeGroup/ip.

telindus1431Router/bridge/bridgeGroup/arp

Default:-
Range: structure, see below

Use this attribute to configure the Address Resolution Protocol (ARP) cache of the bridge.

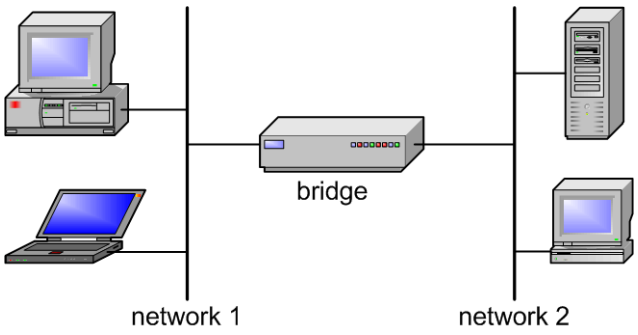
Refer to telindus1431Router/lanInterface/arp on page 394 for a detailed description of the arp structure.

telindus1431Router/bridge/bridgeGroup/bridgeCache

Default:learning
Range: enumerated, see below

Use this attribute to determine how the bridge group should act: as a repeater, a filter or a switch.

The bridgeCache attribute has the following values:

Value	Description
disabled	The bridge group acts as a repeater. All the data which originates from network 1 will be let through to network 2. Even if the data is not destined for that network. 
learning	The bridge group acts as a filter. Data coming from network 1, will only be let through by the bridge if this data has a destination outside network 1 or if it has a broadcast or multicast address. This means the bridge filters the data and decreases the amount of data traffic on the separated LAN segments.
switching	The bridge group acts as a VLAN switch. VLANs on network 1 are switched to VLANs on network 2. Use the vlanSwitching attribute to specify which VLANs you want to switch. Refer to … • telindus1431Router/bridge/bridgeGroup/vlanSwitching on page 547 • 12.3.4 - Configuring VLAN switching on page 313

What is the bridge cache?

Whereas the ARP cache keeps MAC address - IP address pairs, the bridge cache (also called address database) keeps MAC address - interface pairs. This allows the bridge to know which device is reachable through which interface. Refer to telindus1431Router/bridge/bridgeGroup/bridgeCache on page 671 for an example of such a table.

telindus1431Router/bridge/bridgeGroup/bridgeTimeOut

Default:00000d 00h 05m 00s
Range: 00000d 00h 00m 00s-
24855d 03h 14m 07s

Use this attribute to set the ageing time of the bridge cache entries.

The bridge cache time-out

If devices on the network are (re)moved then the MAC address - interface relation changes (refer to What is the bridge cache?). Therefore, the bridge cache entries are automatically removed from the cache after a fixed time-out. This time-out period can be set with the bridgeTimeOut attribute. This in case no topology change is detected, otherwise the time-out is equal to the value of the bridgeForwardDelay element of the spanningTree attribute.

When checking the bridgeCache it may appear that some entries are present for a longer time than is configured with the bridgeTimeOut attribute. This because the entries in the bridgeCache are not monitored continuously, but once per minute. As a result, some entries may appear to be “overtime”. However, this should be no more than ± 75 seconds.

telindus1431Router/bridge/bridgeGroup/spanningTree

Default:-
Range: structure, see below

Use this attribute to configure the bridging related parameters.

Whereas the bridging attribute groups the bridging related parameters per interface, the spanningTree attribute groups the bridging related parameters of the bridge as a whole.

The spanningTree structure contains the following elements:

Element	Description
protocol	Use this element to select the bridging protocol. Default:none Range: enumerated, see below The protocol element has the following values: • none. The Telindus 1431 SHDSL CPE uses the self-learning principle. This means that the bridge itself learns which data it has to forward and which data it has to block. I.e. it builds its own bridging table. • p802.1D. The Telindus 1431 SHDSL CPE uses the self-learning principle in conjunction with the Spanning Tree protocol. Because Spanning Tree bridging is somewhat more complicated than self-learning bridging, an introduction is given in 11.1.2 - The self-learning and Transparent Spanning Tree bridge on page 264. When using Frame Relay or ATM encapsulation on the WAN interface together with the Spanning Tree protocol, every DLCI or PVC link is considered as a separate bridge port. Each link is than considered as a special kind of LAN with only both end points connected.

Element	Description
bridgePriority	Use this element to set the priority of the bridge. Default:32768 Range: 0 ... 65535 The bridge its MAC address together with the bridgePriority element form a unique bridge identifier. This identifier is used to determine which bridge becomes the root bridge. The bridge with the lowest bridgePriority value becomes the root bridge. If two bridges have the same bridgePriority value, then the bridge with the lowest MAC address becomes the root bridge.
bridgeMaxAge	Use this element to set the time the bridge retains bridging information before discarding it. Default:00000d 00h 00m 20s Range: 00000d 00h 00m 06s - 00000d 00h 00m 40s
bridgeHelloTime	Use this element to set the interval by which the root bridge sends Configuration BPDUs, also called Hello messages. Default:00000d 00h 00m 02s Range: 00000d 00h 00m 01s - 00000d 00h 00m 10s
bridgeForwardDelay	Use this element to set … Default:00000d 00h 00m 15s Range: 00000d 00h 00m 04s - 00000d 00h 00m 30s • the delay a bridge port applies to move from listening state to learning state or from learning state to forwarding state. Refer to 11.1.5 - The Spanning Tree bridge port states on page 267 for more information on the possible states of a bridge port. • the time-out (or ageing) for purging MAC addresses from the bridge cache in case a topology change is detected.

telindus1431Router/bridge/bridgeGroup/localAccess

Default:permitted
Range: enumerated, see below

Use this attribute to allow or deny access to the bridge group itself.

The localAccess attribute has the following values:

Value	Description
permitted	Bridged packets can be delivered to the bridge group itself.
restricted	No bridged packets can be delivered to the bridge group itself. This adds some security, because the Telindus 1431 SHDSL CPE can not be accessed through the bridge group. You could for instance create one bridge group specifically for … • management purposes. In this bridge group, set the localAccess attribute to permitted. • the actual data coming from the customers. In this bridge group, set the localAccess attribute to restricted. In this way, the customer can never access the Telindus 1431 SHDSL CPE itself.

telindus1431Router/bridge/bridgeGroup/macAddress

Default:<deviceMac> lan
Range: choice, see below

Use this attribute to determine whether a fixed, a random or a user defined MAC address is associated with the bridge group.

The macAddress attribute has the following values:

Value	Description
deviceMac	A MAC address from the Telindus 1431 SHDSL CPE itself is associated with the bridge group. Use the second part of the macAddress attribute to define which MAC address has to be selected: • lan. The LAN interface its MAC address is associated with the bridge group. • random. The Telindus 1431 SHDSL CPE generates a random MAC address and this is associated with the bridge group.
userMac	A user defined MAC address is associated with the bridge group. Use the second part of the macAddress attribute to enter the MAC address.

telindus1431Router/bridge/bridgeGroup/vlan

Default:-
Range: structure, see below

Use this attribute to set up a VLAN on the bridge group in case you want to manage the Telindus 1431 SHDSL CPE over a VLAN.

Although the Telindus 1431 SHDSL CPE bridges VLAN tagged frames when connected to a VLAN aware switch, the Telindus 1431 SHDSL CPE itself can only be managed via IP if a VLAN is configured on the bridge group. In other words, if you want that the data carried by a VLAN can be delivered to the protocol stack of the Telindus 1431 SHDSL CPE (e.g. so that it can be routed), then you have to configure the VLAN on the bridge group.

You can …

- either configure one single VLAN on the bridge group using the attribute telindus1431Router/bridge/bridgeGroup/vlan on page 543.
- or configure several VLANs on the bridge group using the attribute telindus1431Router/bridge/bridgeGroup/multiVlans on page 545.

The vlan structure contains the following elements:

Element	Description
dotQTagging	Use this element to enable or disable … Default:disabled Range: enabled / disabled • the VLAN tagging of Ethernet frames sent by the Telindus 1431 SHDSL CPE. • the recognition of VLAN tagged Ethernet frames received by the Telindus 1431 SHDSL CPE. As said before, you can *either* use the vlan attribute *or* the multiVlan attribute. So, if you set the dotQTagging element to … • enabled, then only the vlan attribute is considered and the multiVlan attribute is ignored. • disabled, then only the multiVlan attribute is considered and the vlan attribute is ignored.
vid	Use this element to set the VLAN ID over which the Telindus 1431 SHDSL CPE can be managed. Default:1 Range: 1 ... 4094
userPriority	Use this element to set the user priority in the VLAN tag and this for all frames sent by the Telindus 1431 SHDSL CPE. Default:0 Range: 0 ... 7
changeTos	Use this element to enable or disable the COS to TOS mapping. Default:disabled Range: enabled / disabled If you set the changeTos attribute to disabled, then the element cosTosMap is ignored. Note that the *TOS* to *COS* mapping is always enabled, irrespective with the setting of the changeTos attribute.

Element	Description
cosTosMap	Use this element to determine how the VLAN user priority (COS) maps onto the IP TOS byte value. Default:- Range: structure, see below The cosTosMap structure contains the following elements: • p0 ... p7. Use these elements to define which VLAN user priority (0 up to 7) maps onto which IP TOS byte value (0 up to 255). Default:0 Range: 0 ... 7
tosCosMap	Use this element to determine how the IP TOS byte value maps onto the VLAN user priority (COS). Default:- Range: table, see below The tosCosMap table contains the following elements: • startTos and endTos. Use these elements to set the TOS byte value range that has to be mapped. Default:0 Range: 0 ... 255 • cos. Use this element to set the VLAN user priority (COS) value on which the specified TOS byte value range has to be mapped. Default:0 Range: 0 ... 7

telindus1431Router/bridge/bridgeGroup/multiVlans

Default:<empty>
Range: table, see below

Use this attribute to set up (a) VLAN(s) on the bridge group in case you want to manage the Telindus 1431 SHDSL CPE over (a) VLAN(s).

Although the Telindus 1431 SHDSL CPE bridges VLAN tagged frames when connected to a VLAN aware switch, the Telindus 1431 SHDSL CPE itself can only be managed via IP if a VLAN is configured on the bridge group. In other words, if you want that the data carried by a VLAN can be delivered to the protocol stack of the Telindus 1431 SHDSL CPE (e.g. so that it can be routed), then you have to configure the VLAN on the bridge group.

You can …

- either configure one single VLAN on the bridge group using the attribute telindus1431Router/bridge/bridgeGroup/vlan on page 543.
- or configure several VLANs on the bridge group using the attribute telindus1431Router/bridge/bridgeGroup/multiVlans on page 545.

The multiVlans table contains the following elements:

Element	Description
name	Use this element to assign an administrative name to the VLAN. Default:<empty> Range: 0 … 24 characters
adminStatus	Use this element to activate (up) or deactivate (down) the VLAN. Default:up Range: up / down
ip	Use this element to configure the IP related parameters of the VLAN. Default:- Range: structure, see below Refer to … • 5.2 - Configuring IP addresses on page 57 for general information on configuring IP addresses. • 5.2.3 - Explaining the ip structure on page 60 for a detailed description of the ip structure.
vlan	Use this element to configure the specific VLAN parameters. Default:- Range: structure, see below Refer to telindus1431Router/bridge/bridgeGroup/multiVlans/vlan on page 546 for a detailed description of the vlan structure.

telindus1431Router/bridge/bridgeGroup/multiVlans/vlan

Default:-
Range: structure, see below

Use this structure to configure the specific VLAN related parameters of a VLAN.

The vlan structure contains the following elements:

Element	Description
vid	Use this element to set the VLAN ID. Default:1 Range: 1 ... 4095
txCos	Use this element to set the default user priority (802.1P, also called COS) of the transmitted VLAN frames. Default:0 Range: 0 ... 7
changeTos	Use this element to enable or disable the COS to TOS mapping. Default:disabled Range: enabled / disabled If you set the changeTos attribute to disabled, then the element cosTosMap is ignored. Note that the *TOS* to *COS* mapping is always enabled, irrespective with the setting of the changeTos attribute.
cosTosMap	Use this element to determine how the VLAN user priority (COS) maps onto the IP TOS byte value. Default:- Range: structure, see below The cosTosMap structure contains the following elements: • p0 ... p7. Use these elements to define which VLAN user priority (0 up to 7) maps onto which IP TOS byte value (0 up to 255). Default:0 Range: 0 ... 7
tosCosMap	Use this element to determine how the IP TOS byte value maps onto the VLAN user priority (COS). Default:- Range: table, see below The tosCosMap table contains the following elements: • startTos and endTos. Use these elements to set the TOS byte value range that has to be mapped. Default:0 Range: 0 ... 255 • cos. Use this element to set the VLAN user priority (COS) value on which the specified TOS byte value range has to be mapped. Default:0 Range: 0 ... 7
arp	Use this element to configure the Address Resolution Protocol (ARP) cache. Default:- Range: structure, see below Refer to telindus1431Router/lanInterface/arp on page 394 for more information.

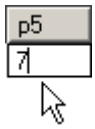
telindus1431Router/bridge/bridgeGroup/vlanSwitching

Default:<empty>
Range: table, see below

Use this attribute specify which VLANs you want to switch in case the bridge group is used as a VLAN switch. Note that you have to enable VLAN switching on the bridge group by setting the bridgeCache attribute to switching. Refer to …

- telindus1431Router/bridge/bridgeGroup/bridgeCache on page 539
- 12.3.4 - Configuring VLAN switching on page 313

The vlanSwitching attribute contains the following elements:

Element	Description
sourceIntf	Use this element to enter the name of the (physical) source interface which carries the VLAN that has to be switched. Default:<empty> Range: 0 ... 24 characters
sourceVlan	Use this element to enter the VLAN ID of the VLAN that has to be switched. Default:1 Range: 0 ... 4094 **Stripping the VLAN tag** Entering 0 as VLAN ID strips the VLAN tag of the Ethernet frame. Example: suppose you enter 1 as srcVlan and 0 as dstVlan. So VLAN 1 is switched from the source interface to the destination interface. But before it is sent out on the destination interface, the VLAN tag is stripped. So instead of VLAN tagged Ethernet frames, plain Ethernet frames are sent out. In the opposite direction however, the VLAN tag is added again.
sourcePMap	Use this element to, if desired, remap the VLAN priorities. The priorities defined in the sourcePMap are applied after the VLAN is switched from destinationVlan to sourceVlan. Default:- Range: structure, see below The structure contains the elements p0 up to p7, which represent priority 0 up to priority 7. If you want to remap priorities, then enter the new priority value under one of these priority elements.  Example: suppose you want to remap priority 5 to priority 7, then enter 7 as value of the p5 element.
destinationIntf	Use this element to enter the name of the (physical) destination interface which carries the VLAN when it has been switched. Default:<empty> Range: 0 ... 24 characters The destination interface can also be a bridge group, in that case just enter the name of the bridge group.
destinationVlan	Use this element to enter the VLAN ID of the VLAN when it has been switched. Default:1 Range: 0 ... 4094 Entering 0 as VLAN ID strips the VLAN tag of the Ethernet frame. Refer to Stripping the VLAN tag for more information.

Element	Description
destinationPMap	Use this element to, if desired, remap the VLAN priorities. The priorities defined in the destinationPMap are applied after the VLAN is switched from sourceVlan to destinationVlan. Default:- Range: structure, see below Refer to the sourcePMap element for more information on this structure.

Note that the switching always happens in both directions (bidirectional, i.e. from source to destination and vice versa).

14.10.2 Bridge access list configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/bridge/accessList[ ]/macAddress on page 550

This object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

telindus1431Router/bridge/accessList[ ]/macAddress

Default:<empty>
Range: table, see below

Use this attribute to filter bridged frames based on the source MAC address.

This is an outbound access list. Packets coming from MAC addresses that are specified in the access list are not sent out on the interface on which the access list is applied.

To apply the access list on a bridge interface, type the index name of the accessList[ ] object as value of the accessList element in the bridging structure.

Example

If you created an accessList object with index name my_access_list (i.e. accessList[my_access_list]) and you want to apply this access list on a bridge interface, then enter the index name as value for the accessList element in the bridging structure.

14.10.3 Bridge traffic policy configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/bridge/trafficPolicy[ ]/vlanPriorityMap on page 552
- telindus1431Router/bridge/trafficPolicy[ ]/dropLevels on page 552

This object is not present in the containment tree by default. If you want to use the feature associated with this object, then add the object first. Refer to 4.4 - Adding an object to the containment tree on page 49.

telindus1431Router/bridge/trafficPolicy[ ]/vlanPriorityMap

Default:-
Range: structure, see below

Use this attribute to impose a bridging traffic policy on the bridged VLAN frames received by the Telindus 1431 SHDSL CPE.

Each VLAN frame has a certain priority (this is specified in the 802.1P part of the 802.1Q header of the VLAN frame). In case a traffic overload condition occurs and in case you imposed this traffic policy on a certain interface, then the VLAN frames are sent to a queue. Using the vlanPriorityMap attribute, you can specify which VLAN frame is sent to which queue based on the priority of the VLAN frame.

The vlanPriorityMap structure contains the following elements:

Element	Description
priority0 … priority7	Use these elements to define which priority corresponds with which queue. The possible queues are: queue1 up to queue5 and lowDelayQueue. To empty these queues, specify a priority policy. Frames that are not tagged are all considered to have priority 0. Refer to 11.3.2 - Configuring a traffic policy on the bridge on page 285 for more information on traffic policy, priority policy and priority queuing.

telindus1431Router/bridge/trafficPolicy[ ]/dropLevels

Default:-
Range: table, see below

Use this attribute to define for each user configurable queue, how many packets may be queued before they are dropped.

The dropLevels table contains the following element:

Element	Description	
dropLevel1	Use this element to set the maximum length, in packets, of each user configurable queue.	Default:100 Range: 1 ... 3000

14.11 SNMP configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/snmp/trapDestinations on page 554
- telindus1431Router/snmp/mib2Traps on page 554

telindus1431Router/snmp/trapDestinations

Default:<empty>
Range: table, see below

Use this attribute to define to which IP address the SNMP traps have to be sent.

The Telindus 1431 SHDSL CPE translates all alarm status changes into SNMP traps. These traps can then be sent to a management system. To enable this, configure in the trapDestinations table the IP addresses to which the traps have to be sent. If the trapDestinations table is empty then no traps are sent.

The trapDestinations table contains the following elements:

Element	Description
address	Use this element to set the IP address of the management station to which the SNMP trap messages have to be sent. Default:0.0.0.0 Range: up to 255.255.255.255
community	Use this element to set the community string which is included in the SNMP traps that are sent to the management station. It is used as a password in the SNMP communication. Give it the same value as on your SNMP management station. Default:public Range: 0 ... 20 characters

telindus1431Router/snmp/mib2Traps

Default:off
Range: on / off

Use this attribute to enable (on) or disable (off) the sending of SNMP traps as MIB2 traps.

If you want to send the SNMP traps as MIB2 traps, proceed as follows:

Step	Action
1	Select the snmp/trapDestinations attribute. Add an entry to this table for each network management station that should receive SNMP traps. Refer to telindus1431Router/snmp/trapDestinations on page 554.
2	Configure the mib2Traps attribute: • on. The alarms coldBoot, warmBoot and linkDown are sent as MIB2 traps instead of enterprise specific (private) MIB traps. • off. All alarms are sent as enterprise specific (private) MIB traps.
3	Set for each object of the Telindus 1431 SHDSL CPE: • the alarms that you want to send using the attribute alarmMask. • the importance of each alarm using the attribute alarmLevel. By default only the most important alarms are enabled.

14.12 Management configuration attributes

This section describes the following configuration attributes:

- telindus1431Router/management/sysLog on page 556
- telindus1431Router/management/timeServer on page 558
- telindus1431Router/management/timeZone on page 558
- telindus1431Router/management/cms2Address on page 559
- telindus1431Router/management/accessList on page 560
- telindus1431Router/management/snmp on page 561
- telindus1431Router/management/telnet on page 561
- telindus1431Router/management/tftp on page 561
- telindus1431Router/management/ftp on page 561
- telindus1431Router/management/accessPolicy on page 561
- telindus1431Router/management/consoleNoTrafficTimeOut on page 562
- telindus1431Router/management/alarmFilter on page 562
- telindus1431Router/management/timedStatsAvailability on page 562
- telindus1431Router/management/atwinGraphics on page 563
- telindus1431Router/management/loginControl on page 564
- telindus1431Router/management/ctrlPortProtocol on page 565
- telindus1431Router/management/loopback/ipAddress on page 565
- telindus1431Router/management/loopback/ipNetMask on page 565

telindus1431Router/management/sysLog

Default:-
Range: structure, see below

Use this attribute to configure the sending of syslog messages.

The sysLog structure contains the following elements:

Element	Description
separator	Use this element to specify the separator character in the syslog messages. Refer to What is syslog? on page 556 for more information on the syslog messages. Default:; Range: 1 character
destinations	Use this element to enter the IP address(es) of the syslog server(s). Up to 3 addresses can be entered. Default:<empty> Range: table, see below As soon a valid syslog server address is entered, a syslog message is sent to this server for each (unmasked) alarm that occurs. If multiple syslog server addresses are sent, then the syslog messages are sent to all servers. The syslog messages are not sent in case the interface or the route through which they have to be sent is down. In this case, the syslog messages are kept in a history list (maximum 31 messages). These pending messages are sent as soon as the interface and/or route comes up again.

What is syslog?

The syslog protocol (RFC 3164) is used for the transmission of event notification messages across networks.

A syslog message is sent on UDP port 514. It has the following format:

`"<facility*8+severity> date hostname message"`

where …

- the priority value is the number contained within the angle brackets, i.e. `<facility*8+severity>`.
- `facility` is a part of the priority value: `facility = 23 * 8 = 184`
  In this case no facility has been explicitly assigned and therefore a "local use" facility is used (numerical code value 23).
- `severity` is a part of the priority value: `severity = 6 - <alarmLevel of the alarm>`
  The severity only ranges from 0 up to 6. So in case the alarm level of an alarm is bigger than 6, the severity is limited to 0.
- `date` is the date the syslog message was generated: `Mmm dd hh:mm:ss` (e.g. `Jan 01 12:45:55`).
- `hostname` is the IP address of the interface through which the syslog message was sent (e.g. `10.0.28.3`).
- `message` is the alarm message. It has the following format:
  `"alarm:<sysName>;<realTimeClock>;<sysUpTime>;<devSeverityLevel>;<severityLevel>;<alarmMessage>"`
  where …
  - `<sysName>` is the sysName configured in the Telindus 1431 SHDSL CPE.
  - `<realTimeClock>` is the value of the real time clock at the moment the alarm was generated: `dd/mm/yy hh:mm:ss` (e.g. `25/12/02 22:45:55`).
  - `<sysUpTime>` is the system up-time of the Telindus 1431 SHDSL CPE at the moment the alarm was generated: `xxxxxd xxh xxm xxs` (e.g. `00025d 08h 45m 55s`).

- `<devSeverityLvl>` is the device severity level: `devSeverityLvl = 6 - <totalAlarmLevel of the device>`. The device severity level only ranges from 0 up to 6. So in case the total alarm level of the Telindus 1431 SHDSL CPE is bigger than 6, the device severity level is limited to 0.
- `<severityLvl>` is the alarm severity level: `severityLvl = 6 - <alarmLevel of the alarm>`. The alarm severity level only ranges from 0 up to 6. So in case the alarm level of an alarm is bigger than 6, the alarm severity level is limited to 0.
- `<alarmMessage>` is the alarm itself: `path.alarmName on|off` (e.g. `telindus1431Router/lanInterface.linkDown on`).
- `;` is the separator character. If desired, you can specify another separator character. Refer to the configuration element separator on page 556.

Example:

The following gives an example of a complete syslog message. In this case, the separator is the `^` character.

```
"<189>Feb 28 16:56:15 10.0.28.2 alarm:telindus1431Router^28/02/03 16:56:15^130^3^5^
telindus1431Router.configChanged on"
```

telindus1431Router/management/timeServer

Default:0.0.0.0
Range: up to 255.255.255.255

Use this attribute to enter the IP address of the SNTP time server with which the Telindus 1431 SHDSL CPE can synchronise its clock. Date and time are displayed in the status attributes telindus1431Router/date and telindus1431Router/time.

You can also set the time zone and the daylight saving time using the configuration attribute telindus1431Router/management/timeZone on page 558.

What is SNTP?

Short for Simple Network Time Protocol, a simplified version of NTP. SNTP is used when the ultimate performance of the full NTP implementation described in RFC 1305 is not needed or justified.

The Telindus 1431 SHDSL CPE can only act as an SNTP client, not as an SNTP server.

telindus1431Router/management/timeZone

Default:-
Range: structure, see below

Use this attribute to set the time zone when using an SNTP time server. Refer to telindus1431Router/management/timeServer on page 558.

The timeZone structure contains the following elements:

Element	Description
timeZone	Use this element to set the time zone. Default:utc+1 Range: enumerated, see below The timeZone element has the following values: utc, utc+1 up to utc+12 and utc-1 up to utc-12. **What is UTC?** UTC is the coordinated universal time, formerly known as Greenwich mean time (GMT). It is the international time standard.
daylightSaving	Use this element to set the daylight saving time. Default:europeanUnion Range: europeanUnion / none The daylightSaving element has the following values: europeanUnion and none.

telindus1431Router/management/cms2Address

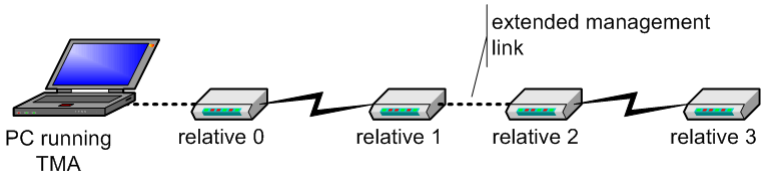
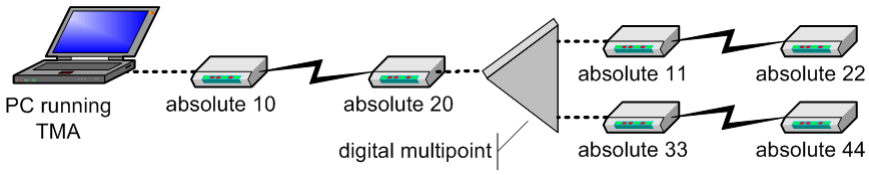
Default:0
Range: 0 ... 65535

Use this attribute to assign an absolute address to the Telindus 1431 SHDSL CPE.

What is relative and absolute addressing?

If you want to connect with TMA to a Telindus device, you have to specify the address of the device in the *Connect…* window. Refer to 4 - Maintaining the Telindus 1431 SHDSL CPE on page 35.

There are two different address types: relative and absolute. The following table explains the difference between these address types:

Type	Description
relative	This type of addressing is meant for a network topology where the Telindus devices are connected in-line on management level. I.e. with extended management connections between two Telindus devices. An extended management connection is realised with a crossed cable between the control connectors of two Telindus devices.  To enable relative addressing, no address has to be specified in the Telindus device. In other words, leave the cms2Address attribute at its default value, being 0.
absolute	This type of addressing is meant for a network topology where the Telindus devices are not connected in-line on management level. I.e. when there is a digital multipoint device present (e.g. an Orchid DM).  To enable absolute addressing, an address has to be specified in the Telindus device. Do this using the cms2Address attribute. The absolute addressing range goes from 1 up to 65535.

telindus1431Router/management/accessList

Default:<empty>
Range: table, see below

Use this attribute to set up an inbound simple access list on the protocol stack. Refer to 12.2 - Configuring the access restrictions on page 294 for more information on inbound access lists.

The access list filters incoming traffic, based on the source IP address. You can specify multiple entries within the access list. When more than one entry applies to the same packet, then only the most specific one is taken in consideration. I.e. the entry covering the smallest range. If not one entry matches, then the packet is dropped. If the access list is empty, then all packets are forwarded.

The accessList table contains the following elements:

Element	Description
sourceAddress	Use this element to set the IP source address of the packet. The address may be a (sub)network address. Default:0.0.0.0 Range: up to 255.255.255.255
mask	Use this element to set the IP subnet mask for the sourceAddress. By combining an IP address with a mask you can uniquely identify a range of addresses. Default:255.255.255.255 Range: up to 255.255.255.255
action	Use this element to set the action when a packet arrives with a source IP address that falls within the specified address range. Default:deny Range: enumerated, see below The possible actions are: • deny. The packet is dropped. • allow. The packet is forwarded.

If you specify one entry or multiple entries for which the action is set to deny, then also specify at least one entry for which the action is set to allow. Else all packets are dropped!

Example 1

This example shows an access list that only allows traffic from subnet 192.168.48.0, except for packets from station 192.168.48.10.

accessList

	sourceAddress	mask	action
1	192.168.48.0	255.255.255.0	allow
2	192.168.48.10	255.255.255.255	deny

Example 2

The next example shows an access list that allows all traffic, except the traffic from subnet 192.168.48.0. The second entry is the rule to add if you want all packets that do not match the previous entries to be allowed.

accessList

	sourceAddress	mask	action
1	192.168.48.0	255.255.255.0	deny
2	0.0.0.0	0.0.0.0	allow

telindus1431Router/management/accessPolicy

Default:<empty>
Range: 0 ... 24 characters

Use this attribute to apply an inbound extended access list on the protocol stack.

Do this by entering the index name of the traffic policy you want to apply. You can create the traffic policy itself by adding a trafficPolicy object and by configuring the attributes in this object.

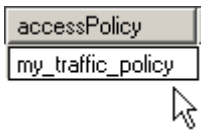
Important remark

It is possible that the Telindus 1431 SHDSL CPE has to answer to DHCP requests or terminate L2TP and IPSec tunnels. In that case, if you set up an access list on the protocol stack, then make sure that these protocols are allowed access to the protocol stack.

Refer to 12.2 - Configuring the access restrictions on page 294 for more information on inbound access lists.

Example

If you created a trafficPolicy object with index name my_traffic_policy (i.e. trafficPolicy[my_traffic_policy]) and you want to apply this traffic policy here, then enter the index name as value for the trafficPolicy element.



telindus1431Router/management/snmp

Default:enabled
Range: enabled / disabled

Use this attribute to accept (enabled) or discard (disabled) SNMP requests.

telindus1431Router/management/telnet

Default:enabled
Range: enabled / disabled

Use this attribute to accept (enabled) or discard (disabled) Telnet sessions.

Use this attribute also to accept (enabled) or discard (disabled) HTTP (Web Interface) sessions.

telindus1431Router/management/tftp

Default:enabled
Range: enabled / disabled

Use this attribute to accept (enabled) or discard (disabled) TFTP sessions.

telindus1431Router/management/ftp

Default:enabled
Range: enabled / disabled

Use this attribute to accept (enabled) or discard (disabled) FTP sessions.

telindus1431Router/management/consoleNoTrafficTimeOut

Default:00000d 00h 30m 00s
Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s

Use this attribute to set the time-out period after which a management session is closed when there is no user interaction. The purpose of such a timer is to protect the Telindus 1431 SHDSL CPE against unauthorised access in case the last user did not close his session.

This timer applies on …

- terminal (emulation) sessions (through the control port).
- Telnet and HTTP sessions (over IP).

It does not apply on TMA or TMA CLI sessions (nor through the control port, nor over IP). They have a fixed time-out of 15 minutes.

telindus1431Router/management/alarmFilter

Default:0
Range: 0 ... 50000

Use this attribute to selectively ignore / drop alarms in TMA for HP OpenView if these alarms are below a certain level.

The filter number that you define using the alarmFilter attribute, has to correspond with a filter that you have to define in the Alarm Manager of TMA for HP OpenView. In the Alarm Manager, it is possible to specify a minimum alarm level that is needed before alarms are logged in HP OpenView. This can be specified for each filter number.

telindus1431Router/management/timedStatsAvailability

Default:basic
Range: enumerated, see below

Use this attribute to determine whether the nested tables in the timed performance statistics (i.e. 2 hour, 24 hour and 7 days performance statistics) are visible or not.

The timedStatsAvailability attribute has the following values:

Value	Description
none	Only the “first level” timed performance statistics are available. In other words, the nested tables (i.e. a table in a table) in the timed performance statistics are not displayed.
basic	The full performance statistics are available on the physical interfaces only (e.g. the LAN interface, etc.). Not on the logical interfaces (e.g. a PVC, a VLAN, etc.).
full	The full performance statistics are available on both the physical (e.g. the LAN interface, etc.) and logical (e.g. a PVC, a VLAN, etc.) interfaces If you have a lot of PVCs this may require quite some memory space and processing power.

telindus1431Router/management/atwinGraphics

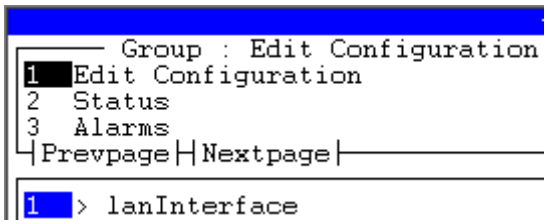
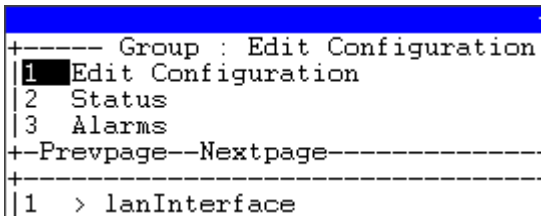
Default:enabled
Range: enabled / disabled

Use this attribute to enable or disable the graphical symbols in the ATWIN user interface.

One of the tools that allows you to manage the Telindus 1431 SHDSL CPE is ATWIN (refer to 1.4 - Maintenance and management tools on page 8). ATWIN is a basic, menu-driven user interface. You can start it using a terminal (emulation program) on the control port or using Telnet on an IP interface (e.g. the LAN interface) and by typing `atwin` at the command prompt (refer to the Maintenance tools manual (PDF) for more information).

By default, ATWIN uses graphical symbols to draw the borders of the “windows”. In some cases however, these graphical symbols are displayed incorrectly. In that case you can choose to disable the graphical symbols. By doing so, the window borders are drawn using + and - signs.

The atwinGraphics attribute has the following values:

Value	Description
enabled	The ATWIN window borders are drawn using graphical symbols. 
disabled	The ATWIN window borders are drawn using + and - signs. 

telindus1431Router/management/loginControl

Default:-
Range: structure, see below

Use this attribute to configure the monitoring of management access to the device.

The loginControl structure contains the following elements:

Element	Description

alarm	Use this element to determine when the access failure alarm should be logged in the accessLog table and a syslog message is sent.
	Default:-
	Range: structure, see below
	
	The alarm structure contains the following elements:
	
	• maxFailCnt. Use this element to set the access failure alarm threshold. If this value is exceeded within the access failure alarm period, then the access failure alarm is raised.
	Default:3
	Range: 0 ... 100
	
	• period. Use this element to set the access failure alarm period. If within this period the access failure alarm threshold is exceeded, then the access failure alarm is raised.
	Default:00000d 00h 15m 00s
	Range: 00000d 00h 00m 00s - 00001d 00h 00m 00s
	
	Example
	
	By default, if within a period of 15 minutes 3 access attempts fail, then the access failure alarm is logged in the accessLog table as follows:
	`Jul 13 11:00:00 00000d 00h 15m 58s accessFailureOn`
	
	If within the consecutive period of 15 minutes no or less than 3 access attempts fail, then the access failure alarm is cleared in the accessLog table as follows:
	`Jul 13 11:15:00 00000d 00h 30m 58s accessFailureOff`
	
	Also see telindus1431Router/management/accessLog on page 677.

telindus1431Router/management/ctrlPortProtocol

Default:console
Range: enumerated, see below

Use this attribute to set the function of the control connector.

The ctrlPortProtocol attribute has the following values:

Value	Description
management	Select this value if you want to connect the control connector of the Telindus 1431 SHDSL CPE to … • a management concentrator for management purposes. • the control connector of another Telindus device using a crossed cable (i.e. they are connected back-to-back) in order to create an extended management link. Refer to What is relative and absolute addressing? on page 559 for more information on extended management links. When connecting the control connector of the Telindus 1431 SHDSL CPE to a COM port of your computer, you can still open a TMA session on the Telindus 1431 SHDSL CPE. You can however not open a CLI or ATWIN session.
console	Select this value if you want to connect the control connector of the Telindus 1431 SHDSL CPE to a COM port of your computer in order to manage the Telindus 1431 SHDSL CPE using TMA, CLI, ATWIN, etc.

telindus1431Router/management/loopback/ipAddress

Default:0.0.0.0
Range: up to 255.255.255.255

Use this attribute to assign an IP address to the loopback interface.

The loopback interface is a software interface which can be used for management purposes. This interface is always up, regardless of the state of the physical interfaces. This means the router will always respond to ICMP echo requests sent to this address. In every other respect the loopback address behaves the same as an IP address of a physical interface.

If the loopback address is used and RIP is active, then a host route to the loopback address is included in the RIP updates.

telindus1431Router/management/loopback/ipNetMask

Default:0.0.0.0
Range: up to 255.255.255.255

Use this attribute to assign an IP netmask to the loopback interface.

Also see telindus1431Router/management/loopback/ipAddress on page 565.

15 Status attributes

This chapter discusses the status attributes of the Telindus 1431 SHDSL CPE. The following gives an overview of this chapter:

- 15.1 - Status attribute overview on page 568
- 15.2 - General status attributes on page 574
- 15.3 - LAN interface status attributes on page 578
- 15.4 - WAN interface status attributes on page 586
- 15.5 - Encapsulation status attributes on page 589
- 15.6 - SHDSL line status attributes on page 610
- 15.7 - End status attributes on page 618
- 15.8 - Modular user interface status attributes on page 621
- 15.9 - Router status attributes on page 630
- 15.10 - Bridge status attributes on page 668
- 15.11 - Management status attributes on page 675
- 15.12 - File system status attributes on page 680
- 15.13 - Operating system status attributes on page 683

15.1 Status attribute overview

Refer to 4.3 - The objects in the Telindus 1431 SHDSL CPE containment tree on page 46 to find out which objects are present by default, which ones you can add yourself and which ones are added automatically.

> telindus1431Router
- sysDescr
- sysObjectID
- sysUpTime
- sysServices
- flash1Version
- flash2Version
- activeFlash
- flashVersions
- bootVersion
- loaderVersion
- tdreVersion
- messages
- deviceId
- configurationSaving
- date
- time
- Action: Set Date
- Action: Set Time

>> lanInterface
- ifDescr
- ifType
- ifOperStatus
- ifLastChange
- ifSpeed
- ifMtu
- ip
- macAddress
- arpCache
- bridging
- adapter
- vlan
- ipAdEntBcastAddr
- ipAdEntReasmMaxSize
- Action: clearArpCache

>> wanInterface
- ifDescr
- ifType
- ifOperStatus
- ifLastChange
- ifSpeed
- ifMtu

>>> atm
- atmSync
- pvcTable
- vp
- frAtm

>>> line
- ifDescr
- ifType
- ifOperStatus
- ifSpeed
- region
- maxSpeedSearch
- maxSpeedResult
- linePairsSwapped
- eocAlarmThresholds
- testType
- testStatus
- testOriginator
- Action: maximumSpeedSearch
- Action: testActivation

>>>> linePair[ ]
- ifSpeed
- ifOperStatus
- status
- timeSinceLastRetrain
- lineAttenuation
- signalNoise
- actualBitRate
- transmitPower

>>> end
- vendorId
- vendorModel
- vendorSerial
- vendorSoftVersion
- eocSoftVersion
- shdslVersion
- eocState
- eocAlarmThresholds

>>>> linePair[ ]
- lineAttenuation
- signalNoise

>> g703
ifDescr
ifType
ifOperStatus
ifSpeed
ifClocking
coding
testType
testStatus
los
lfa
ais
rai
channelTable
jitterAttenuator
Action: testActivation

>>> channel[g703_1]
ifDescr
ifType
ifOperStatus
ifLastChange
ifSpeed
ifMtu

>>>> frameRelay
dlciTable
lmi
cllmLastCongestionCause

>>>> ces
state
outstandingCells

>>> transpChannel[ ]
<Contains the same attributes as the channel[g703_1] object. It also contains the ces sub-object. It does not contain the frameRelay sub-object.>

>> <serialIf>
ifDescr
ifType
ifOperStatus
ifLastChange
ifSpeed
ifMtu
ifClocking
testType
testStatus
txdItu103
rxdItu104
rtsItu105[1]
ctsItu106[1]
dsrItu107[1]
dcdItu109[1]
indicator[2]
Action: testActivation

>>> frameRelay
dlciTable
lmi
cllmLastCongestionCause
ifClocking

>>> ces
state
outstandingCells
ifClocking

>> router
routingTable
igmpTable
dhcpBinding
dhcpStatistics
dhcpBlackList
radius
dns
dnsServers
Action: unBlacklist

>>> defaultNat
addresses

1. RS530, V35 and V36 only
2. X21 only

```
>>> tunnels
    l2tpTunnels
    ipsecL2tpTunnels

>>> ospf
    type
    routers
    externalRoutes
    asExtLsas

>>>> area
        interfaces
        hosts
        neighbors
        routers
        stub
        routerLsas
        networkLsas
        summLsas
        asbrLsas
        nssaLsas

>>> vrrp[ ]
    macAddress
    interfaces
    criticals

>> bridge

>>> bridgeGroup
    ifDescr
    ifType
    ifOperStatus
    ifMtu
    ip
    arpCache
    bridgeCache
    bridging
    spanningTree
    Action: clearArpCache
    Action: clearBridgeCache

>> management
  cms2Address
  timeServer
  alarmLog
  accessLog
```

>>> loopback
ifDescr
ifType
ifOperStatus
ifMtu
ipAddress

>> fileSystem
fileList
freeSpace
status
corruptBlocks
Action: Delete File
Action: Rename File

>> operatingSystem
taskInfo

15.2 General status attributes

This section describes the following status attributes:

- telindus1431Router/sysDescr on page 575
- telindus1431Router/sysObjectID on page 575
- telindus1431Router/sysUpTime on page 575
- telindus1431Router/sysServices on page 575
- telindus1431Router/flash1Version on page 575
- telindus1431Router/flash2Version on page 575
- telindus1431Router/activeFlash on page 576
- telindus1431Router/flashVersions on page 576
- telindus1431Router/bootVersion on page 576
- telindus1431Router/loaderVersion on page 576
- telindus1431Router/tdreVersion on page 576
- telindus1431Router/messages on page 576
- telindus1431Router/deviceId on page 577
- telindus1431Router/configurationSaving on page 577
- telindus1431Router/date on page 577
- telindus1431Router/time on page 577

This section describes the following actions:

- telindus1431Router/Set Date on page 577
- telindus1431Router/Set Time on page 577

telindus1431Router/sysDescr

This attribute displays a textual description of the device.

Example: Telindus 1431 SHDSL CPE Txxxx/xxxxx 01/01/00 12:00

In this example the following parameters are visible:

- Telindus 1431 SHDSL CPE is the device name.
- Txxxx/xxxxx is the application software code and version.
- 01/01/00 12:00 is the application software release date and time.

telindus1431Router/sysObjectID

This attribute displays the identification string.

telindus1431Router/sysUpTime

This attribute displays the elapsed time since the last power-on or cold boot of the Telindus 1431 SHDSL CPE.

telindus1431Router/sysServices

This attribute displays the service identification.

telindus1431Router/flash1Version

This attribute displays the code and version of the application software stored as CONTROL1.

Example: Txxxx/xxxxx 01/01/00 12:00

In this example the following parameters are visible:

- Txxxx is the application software code for this device.
- /xxxxx is the application software version.
- 01/01/00 is the application software release date.
- 12:00 is the application software release time.

telindus1431Router/flash2Version

This attribute displays the code and version of the application software stored as CONTROL2.

Example: Txxxx/xxxxx 01/01/00 12:00

In this example the following parameters are visible:

- Txxxx is the application software code for this device.
- /xxxxx is the application software version.
- 01/01/00 is the application software release date.
- 12:00 is the application software release time.

telindus1431Router/activeFlash

This attribute displays which application software is currently active. Possible values are:

Value	Description
flash1	The application software CONTROL1 is active.
flash2	The application software CONTROL2 is active.

telindus1431Router/flashVersions

This attribute displays how many application software versions can be stored in the file system.

telindus1431Router/bootVersion

This attribute displays the code, version, release date and time of the boot software currently used in the Telindus 1431 SHDSL CPE.

telindus1431Router/loaderVersion

This attribute displays the code, version, release date and time of the loader software currently used in the Telindus 1431 SHDSL CPE.

telindus1431Router/tdreVersion

This attribute displays the version of the TDRE (Telindus Dynamic Routing Engine) currently used in the Telindus 1431 SHDSL CPE.

Example: xxx.yyy.zzz

In this example the following parameters are visible:

- xxx is the major TDRE version. This number is incremented only when a complete new version of the TDRE is released.
- yyy is the minor TDRE version. This number is incremented every time new features are added to the TDRE.
- zzz is the build version. This number is incremented every time a new TDRE version is built (also in case of bug fixes etc.).

telindus1431Router/messages

This attribute displays informative and error messages, e.g. Reconfigured, Cold Boot, … The messages table displays maximum 20 messages.

If you open a TMA session on the Telindus 1431 SHDSL CPE over IP, i.e. not through the control port, then the messages are also sent to the control port. This means that if you open a terminal emulation session on the control port, you can monitor these messages. If you hit the ENTER key, the messages stop and you get the (CLI) password prompt.

telindus1431Router/deviceId

This attribute displays a unique code. This code is programmed into the Telindus 1431 SHDSL CPE before it leaves the factory. You can use this code for inventory purposes.

telindus1431Router/configurationSaving

This attribute indicates when the Telindus 1431 SHDSL CPE is writing its (new) configuration to the flash memory. Possible values are:

Value	Description
busy	The Telindus 1431 SHDSL CPE is busy writing its configuration to the flash memory. During this state, do not power-down or reboot the Telindus 1431 SHDSL CPE else the new configuration will be lost.
done	The Telindus 1431 SHDSL CPE has finished writing its configuration to the flash memory.

telindus1431Router/date

This attribute displays the current date in the format dd/mm/yy (e.g. 01/01/00).

telindus1431Router/time

This attribute displays the current time in the format hh:mm:ss (e.g. 12:30:45).

telindus1431Router/Set Date

Use this action to set the current date. Enter the date as argument value in the format dd/mm/yy (e.g. 01/01/00). Then execute the action.

telindus1431Router/Set Time

Use this action to set the current time. Enter the time as argument value in the format hh:mm:ss (e.g. 12:30:45). Then execute the action.

15.3 LAN interface status attributes

This section describes the following status attributes:

- telindus1431Router/lanInterface/ifDescr on page 579
- telindus1431Router/lanInterface/ifType on page 579
- telindus1431Router/lanInterface/ifOperStatus on page 579
- telindus1431Router/lanInterface/ifLastChange on page 579
- telindus1431Router/lanInterface/ifSpeed on page 579
- telindus1431Router/lanInterface/ifMtu on page 579
- telindus1431Router/lanInterface/ip on page 580
- telindus1431Router/lanInterface/macAddress on page 580
- telindus1431Router/lanInterface/arpCache on page 581
- telindus1431Router/lanInterface/bridging on page 582
- telindus1431Router/lanInterface/adapter on page 584
- telindus1431Router/lanInterface/vlan on page 584
- telindus1431Router/lanInterface/ipAdEntBcastAddr on page 585
- telindus1431Router/lanInterface/ipAdEntReasmMaxSize on page 585

This section describes the following actions:

- telindus1431Router/lanInterface/clearArpCache on page 585

telindus1431Router/lanInterface/ifDescr

This attribute displays the interface description.

telindus1431Router/lanInterface/ifType

This attribute displays the interface type.

telindus1431Router/lanInterface/ifOperStatus

This attribute displays the current operational status of the interface.

telindus1431Router/lanInterface/ifLastChange

This attribute shows the system-up time on the moment the interface entered its current operational state. I.e. the moment the value of the ifOperStatus status attribute changes (from up to down or vice versa), the system-up time value is written into the ifLastChange status attribute.

telindus1431Router/lanInterface/ifSpeed

This attribute displays the interface speed in bits per second (bps).

telindus1431Router/lanInterface/ifMtu

This attribute displays the interface its Maximum Transfer Unit, i.e. the maximum number of bytes that one packet can contain on this interface.

telindus1431Router/lanInterface/ip

This attribute displays the IP information of the interface.

The ip structure contains the following elements:

Element	Description
status	This is the current operational status of the IP layer (layer 3).
address	This is the IP address of the interface. It is either configured or retrieved automatically.
netMask	This is the IP subnet mask of the interface. It is either configured or retrieved automatically.

telindus1431Router/lanInterface/macAddress

This attribute displays the MAC address of the Telindus 1431 SHDSL CPE its LAN interface.

The LAN interface has been allocated a fixed Ethernet address, also called MAC (Medium Access Control) address. The MAC address is globally unique and can not be modified. It is a 6 byte code, represented in hexadecimal format. Each byte in the code is separated by a colon.

Refer to What is the ARP cache? on page 394 for more information on the MAC addresses.

telindus1431Router/lanInterface/arpCache

This attribute displays all the MAC address - IP address pairs from ARP requests and replies received on the LAN interface. Refer to What is the ARP cache? on page 394 for more information.

The arpCache table contains the following elements:

Element	Description
macAddress	This is the MAC address.
ipAddress	This is the associated IP address.
type	This is the ARP cache entry type. Possible values are: • dynamic. The MAC - IP address pair is retrieved from an ARP request or reply message. • static. The MAC - IP address pair is configured. There is only one static entry, i.e. the Telindus 1431 SHDSL CPE its own IP and MAC address.
timeOut	This is the time the entry will remain in the ARP cache. For the static entry, this value is 0.

Example

The following figure shows part of an ARP cache table as an example:

arpCache

	macAddress	ipAddress	type	timeout
1	00:20:AF:BD:A7:9B	194.7.48.84	dynamic	00000d 01h 12m 17s
2	00:00:0C:40:29:B1	194.7.48.37	dynamic	00000d 01h 59m 55s
3	00:50:8B:2E:3B:94	194.7.48.163	dynamic	00000d 01h 59m 56s
4	00:10:4B:B1:34:1C	10.0.8.128	dynamic	00000d 01h 58m 19s
5	00:50:04:40:8B:C2	194.7.48.148	dynamic	00000d 01h 59m 56s
6	00:08:C7:09:40:10	194.7.48.10	dynamic	00000d 01h 59m 02s
7	00:10:5A:AD:32:56	194.7.48.185	dynamic	00000d 01h 58m 11s
8	00:10:5A:FB:BA:8E	10.0.8.154	dynamic	00000d 01h 55m 06s
9	00:20:AF:F1:EE:3A	10.0.8.180	dynamic	00000d 01h 56m 48s
10	00:10:83:27:17:97	194.7.48.60	dynamic	00000d 01h 59m 31s

telindus1431Router/lanInterface/bridging

This attribute displays the bridging status of the interface.

The bridging structure contains the following elements:

Element	Description
state	This displays the current state of the port. Possible values are: • disabled[1]. The port is not in use because of a management action. • blocking. The port does not participate in frame forwarding. • listening. The port prepares to participate in frame forwarding, but it does not update its MAC address database (also called bridge cache). • learning. The port prepares to participate in frame forwarding, and it learns the present MAC addresses. • forwarding[1]. The port participates in frame forwarding. Refer to 11.1.5 - The Spanning Tree bridge port states on page 267 for more information on port states[2].
subState[2]	This gives additional information on the port state. Possible values are: • root. This is the port through which the root bridge can be reached. Consequently, the root bridge itself does not have a root port. All other bridges must have a root port. • designated. This is the designated port for this (virtual) LAN. All ports of the root bridge are designated ports. • alternate. This port is not active. Either because of a management action, or through protocol intervention.
designatedPriority[2] designatedMac[2]	Together, these two elements form a unique bridge identifier. Depending whether the current port is a designated port or not, these two elements display the unique bridge identifier of … • the bridge to which this port belongs, in case of a designated port. • the bridge believed to be the designated bridge for the LAN that is currently connected to this port, in all other cases. This bridge identifier is used … • together with the designatedPortPriority and designatedPortId attributes to determine whether this port should be the designated port for the LAN that is currently connected to this port. • to test the value of the bridge identifier parameter conveyed in received Configuration BPDUs.

Element	Description
designatedPort-Priority[2]	Together, these two elements form a unique port identifier. They display the unique port identifier of the bridge port through which the designated bridge transmits the configuration message information stored by this port. This port identifier is used … • together with the designatedPriority and designatedMac attributes to determine whether this port should be the designated port for the LAN that is currently connected to this port. • by the management system to determine the topology of the bridged LAN.
designatedPortId[2]	
topologyChangeAck[2]	This displays the value of the Topology Change Acknowledgement flag in the next Configuration BPDU that will be transmitted on this port. This element is used to assess the need to set the Topology Change Acknowledgement flag in response to a received Topology Change Notification BPDU.
configuration-Pending[2]	This is used to determine whether a Configuration BPDU should be transmitted on this port after expiry of the hold timer. This avoids that Configuration BPDUs are transmitted too often, although ensuring that up-to-date information is transmitted.

1. These are the only possible port states for a bridge that is not running the Spanning Tree protocol (IEEE p802.1D).
2. Only relevant when the bridge uses the Spanning Tree Protocol.

telindus1431Router/lanInterface/adapter

This attribute displays the Ethernet mode of the LAN interface as set using the telindus1431Router/lanInterface/adapter attribute.

The adapter structure contains the following elements:

Element	Description
speed	This is the Ethernet speed in Mbps. Possible values are: 10 and 100.
duplex	This is the Ethernet duplex mode. Possible values are: halfDuplex and fullDuplex.

telindus1431Router/lanInterface/vlan

This attribute displays the status of the VLAN(s) on this interface.

The vlan table contains the following elements:

Element	Description
name	This is the name of the VLAN as you configured it. If you did not configure a name, then this element displays: <LAN interface name> "vlan" <VLAN ID>. E.g. lan vlan 2
ifOperStatus	This is the current operational status of the VLAN.
ifLastChange	This is the system-up time on the moment the VLAN entered its current operational state. I.e. the moment the value of the ifOperStatus element changes (from up to down or vice versa), the system-up time value is written into the ifLastChange element.
ip	This displays the IP address and subnet mask of the VLAN.
bridging	This displays the bridging information of the VLAN. Refer to telindus1431Router/lanInterface/bridging on page 582 for a detailed description of the bridging structure.
vlan	This displays the specific VLAN related status information. The vlan structure contains the following elements: • identifier. This element displays the VLAN identifier. • arpCache. This element displays all the MAC address - IP address pairs from ARP requests and replies received on the VLAN. Refer to telindus1431Router/lanInterface/arpCache on page 581 for a detailed description of the arpCache table.

telindus1431Router/lanInterface/ipAdEntBcastAddr

This attribute displays the value of the least-significant bit in the IP broadcast address. This address is used for sending packets on the interface which is associated with the IP address of this entry. The value applies to the general broadcast, the subnet and network broadcasts.

telindus1431Router/lanInterface/ipAdEntReasmMaxSize

This attribute displays the size of the largest IP packet which this entity can re-assemble from incoming IP fragmented packets received on this interface.

telindus1431Router/lanInterface/clearArpCache

Use this action to clear the ARP cache table.

15.4 WAN interface status attributes

This section describes the following status attributes:

- telindus1431Router/wanInterface/ifDescr on page 587
- telindus1431Router/wanInterface/ifType on page 587
- telindus1431Router/wanInterface/ifSpeed on page 587
- telindus1431Router/wanInterface/ifMtu on page 587
- telindus1431Router/wanInterface/ifLastChange on page 587
- telindus1431Router/wanInterface/ifOperStatus on page 587

telindus1431Router/wanInterface/ifDescr

This attribute displays the interface description.

telindus1431Router/wanInterface/ifType

This attribute displays the interface type.

telindus1431Router/wanInterface/ifSpeed

This attribute displays the interface speed in bits per second (bps).

telindus1431Router/wanInterface/ifMtu

This attribute displays the interface its Maximum Transfer Unit, i.e. the maximum number of bytes that one packet can contain on this interface.

telindus1431Router/wanInterface/ifLastChange

This attribute shows the system-up time on the moment the interface entered its current operational state. I.e. the moment the value of the ifOperStatus status attribute changes (from up to down or vice versa), the system-up time value is written into the ifLastChange status attribute.

telindus1431Router/wanInterface/ifOperStatus

This attribute displays the current operational status of the interface. Possible values are:

Value	Description
up	The WAN interface is up, data transfer is possible.
down	The WAN interface is down, data transfer is not possible. The ifOperStatus attribute is down in case of … • ATM, when … - the ATM synchronisation status is “not synched”. - the line is not in data state. - the bit pump is not synchronised.
	• PPP(oA), when … - LCP is not open. - the line is not in data state. - the bit pump is not synchronised.
	• Frame Relay, when … - LMI is not up. - the line is not in data state. - the bit pump is not synchronised.

Important remarks

- Whether the Telindus 1431 SHDSL CPE is configured in bridging or routing has no effect on the value of the attributes wanInterface/ifOperStatus:Status and wanInterface/alarmInfo/linkDown:Alarms.
- In case of ATM, if the configuration element pvcTable/atm/oamF5Loopback is set to disabled, then the ifOperStatus of the PVC becomes up when the ATM is synchronised globally. However, this does not guarantee that the PVC is configured (correctly) on the remote side. However, the other conditions as stated in the table above remain.
- In case of PPP(oA), if the configuration element linkMonitoring/operation is set to disabled, then it is possible that the wanInterface/ifOperStatus value does not go down even if the link quality is too bad for a proper data link. This because the link monitoring mechanism is the only PPP mechanism that will start a renegotiation of the LCP layer.
- In case of Frame Relay, if the configuration element lmi/auto is set to noLmi, then the value of the status element lmi/status:Status is always up. However, the other conditions as stated in the table above remain.

15.5 Encapsulation status attributes

This section discusses the status attributes of the encapsulation protocols that can be used on the Telindus 1431 SHDSL CPE.

The following gives an overview of this section:

- 15.5.1 - ATM status attributes on page 590
- 15.5.2 - Frame Relay status attributes on page 597
- 15.5.3 - CES status attributes on page 602
- 15.5.4 - PPPoA status attributes on page 607

15.5.1 ATM status attributes

This section describes the following status attributes:

- telindus1431Router/wanInterface/atm/atmSync on page 591
- telindus1431Router/wanInterface/atm/pvcTable on page 591
- telindus1431Router/wanInterface/atm/vp on page 595
- telindus1431Router/wanInterface/atm/frAtm on page 596

telindus1431Router/wanInterface/atm/atmSync

This attribute displays the ATM synchronisation status. Possible values are: synced, notSynced.

telindus1431Router/wanInterface/atm/pvcTable

This attribute gives the complete status information of all known PVCs.

The pvcTable table contains the following elements:

Element	Description
name	This is the name of the PVC as you configured it. If you did not configure a name, then this element displays: <interface name> “vpi” <vpi number> “vci” <vci number>. E.g. wan vpi 102 vci 102
ifOperStatus	This is the current operational status of the PVC. In case OAM F5 … • LoopBack (LB) or Continuity Check (CC) is disabled, i.e. no OAM F4 LB/CC cells are sent, then the ifOperStatus of the PVC becomes up when the ATM is synchronised globally. However, this does not guarantee that the PVC is configured (correctly) on the remote side. • LoopBack (LB) is enabled, i.e. OAM F5 loopback cells are sent at regular intervals, then the ifOperStatus of the PVC becomes up when the loopback cells are returned and down when the loopback cells are not returned by the remote side. • Continuity Check (CC) is enabled, i.e. OAM F5 continuity check cells are sent at regular intervals, then the ifOperStatus of the PVC becomes up when the continuity check cells are received and down when the continuity check cells are not received by the remote side.
ifLastChange	This is the system-up time on the moment the PVC entered its current operational state. I.e. the moment the value of the ifOperStatus element changes (from up to down or vice versa), the system-up time value is written into the ifLastChange element.
ip	This displays the IP information of the PVC. Refer to telindus1431Router/wanInterface/atm/pvcTable/ip on page 592 for a detailed description of the ip structure.
bridging	This displays the bridging information of the PVC. Refer to telindus1431Router/lanInterface/bridging on page 582 for a detailed description of the bridging structure.
atm	This displays the specific ATM related status information of the PVC. Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 593 for a detailed description of the atm structure.

telindus1431Router/wanInterface/atm/pvcTable/ip

The ip structure in the pvcTable displays the IP information of the PVC.

The ip structure contains the following elements:

Element	Description
address	This is the IP address of the PVC. It is either configured or retrieved automatically.
netMask	This is the IP subnet mask of the PVC. It is either configured or retrieved automatically.
remote	This is the IP address of the remote end of the PVC. It is either configured or retrieved automatically.

telindus1431Router/wanInterface/atm/pvcTable/atm

The atm structure in the pvcTable displays the specific ATM related status information of the PVC.

The atm structure contains the following elements:

Element	Description
vpi	This displays the Virtual Path Identifier (VPI).
vci	This displays the Virtual Channel Identifier (VCI). The VPI in conjunction with the VCI identifies the next destination of a cell as it passes through a series of ATM switches on the way to its destination.
peakCellRate	This displays the Peak Cell Rate (PCR) of the PVC in bps.
sustCellRate	This displays the Sustainable Cell Rate (SCR) of the PVC in bps.
maxBurstSize	This displays the Maximum Burst Size (MBS) of the PVC in cell times.
pppOverEth	When the Telindus 1431 SHDSL CPE wants to initiate a PPP over Ethernet (PPPoE) session, it must first perform a discovery to identify the Ethernet MAC address of the host and to establish a PPPoE session ID. The pppOverEth structure displays information on the PPPoE discovery. The pppOverEth structure contains the following elements: • discState. This is the state of the discovery. The discovery goes as follows: - The Telindus 1431 SHDSL CPE sends a PADI packet (PPPoE Active Discovery Initiation). - When the host receives a PADI that it can serve, it replies by sending a PADO packet (PPPoE Active Discovery Offer). - The Telindus 1431 SHDSL CPE then sends one PADR packet (PPPoE Active Discovery Request) to the host that it has chosen. - When the host receives a PADR packet, it prepares to begin a PPP session. It generates a unique session ID for the PPPoE session and replies to the Telindus 1431 SHDSL CPE with a PADS packet (PPPoE Active Discovery Session-confirmation). So possible discState values are: idle, waitForPADO, waitForPADS, established. • remoteMacAddress. This is the MAC address of the remote system as learned during the discovery.
ppp	This displays the PPP information of the PVC. Refer to 15.5.4 - PPPoA status attributes on page 607 for a detailed description of the elements in the ppp structure.

Element	Description
oamF5CC	This displays the state of the OAM F5 Continuity Check protocol. The oamF5CC structure only contains one element: the state element. Possible values of the state element are: • ready. This is the idle state. The CC mechanism has not been activated nor has it explicitly been deactivated. • waitActCon. This is the *wait activate confirm* state. I.e. this side has sent a request to activate the CC mechanism (activator cells have been sent), but no response has been received from the remote side yet. • waitActRes. This is the *wait activate response* state. I.e. this side has received a request to activate the CC mechanism (activator cells have been received) and processes the request. • waitDeactCon. This is the *wait deactivate confirm* state. I.e. this side has sent a request to deactivate the CC mechanism (deactivator cells have been sent), but no response has been received from the remote side yet. • active. The CC mechanism has been activated. • deactivated. The CC mechanism has been explicitly deactivated (e.g. by setting the actDeact/initProcedure element to deactivated. For a more detailed description, refer to the ITU-T Recommendation I.610, Annex B.

telindus1431Router/wanInterface/atm/vp

Whereas the pvcTable gives the current operational status for each Virtual Channel, the vp table gives the current operational status of a complete Virtual Path.

The vp table contains the following elements:

Element	Description
vpi	This is the Virtual Path Identifier (VPI).
ifOperStatus	This is the current operational status of the Virtual Path. In case OAM F4 … • LoopBack (LB) or Continuity Check (CC) is disabled, i.e. no OAM F4 LB/CC cells are sent, then the ifOperStatus of the VP becomes up when the ATM is synchronised globally. However, this does not guarantee that the VP is configured (correctly) on the remote side. • LoopBack (LB) is enabled, i.e. OAM F4 loopback cells are sent at regular intervals, then the ifOperStatus of the VP becomes up when the loopback cells are returned and down when the loopback cells are not returned by the remote side. In case a VP goes down, also all VCs belonging to the VP go down. • Continuity Check (CC) is enabled, i.e. OAM F4 continuity check cells are sent at regular intervals, then the ifOperStatus of the VP becomes up when the continuity check cells are received and down when the continuity check cells are not received by the remote side. In case a VP goes down, also all VCs belonging to the VP go down.
oamF4CC	This displays the state of the OAM F4 Continuity Check protocol. The elements contained in this structure are the same as those in the oamF4CC structure. For a detailed description of these elements refer to oamF5CC on page 594.

telindus1431Router/wanInterface/atm/frAtm

This attribute gives a quick overview of the current operational status of the FRF links.

In case you want to use the Frame Relay to ATM interworking (FRF) function, you have to configure the Frame Relay DLCIs and ATM PVCs in the configuration frAtm table. The status of these DLCIs and PVCs can be found in the following attributes:

- the status frAtm table. This gives a short overview of the DLCI - PVC pairs. It only displays the current operational status of the combined DLCI - PVC pair (i.e. the FRF link), of the PVC and of the DLCI.
- the status pvcTable. This gives a complete overview of the PVC that is part of the FRF link.
- the status dlciTable. This gives a complete overview of the DLCI that is part of the FRF link.

The vp table contains the following elements:

Element	Description
name	This is the name of the FRF link as you configured it. If you did not configure a name, then this element displays: <FRF mode> <PVC ID>-<DLCI ID>. E.g. Frf5: pvc 0/32-dlci 16
ifOperStatus	This is the current operational status of the FRF link (i.e. the combined DLCI - PVC pair).
atm	This structure displays the name and current operational status of the PVC that is part of the FRF link. If you want more detailed information of this PVC, you have to look in the status pvcTable. Refer to telindus1431Router/wanInterface/atm/pvcTable on page 591.
frameRelay	This structure displays the name and current operational status of the DLCI that is part of the FRF link. If you want more detailed information of this DLCI, you have to look in the status dlciTable. Refer to telindus1431Router/<modularIf>/frameRelay/dlciTable on page 598.

15.5.2 Frame Relay status attributes

This section describes the following status attributes:

- telindus1431Router/<modularIf>/frameRelay/dlciTable on page 598
- telindus1431Router/<modularIf>/frameRelay/lmi on page 600
- telindus1431Router/<modularIf>/frameRelay/cllmLastCongestionCause on page 601

telindus1431Router/<modularIf>/frameRelay/dlciTable

This attribute gives the complete status information of all known DLCIs.

The dlciTable table contains the following elements:

Element	Description
name	This is the name of the DLCI as you configured it. If you did not configure a name, then this element displays: <interface name> “dlci” <dlci number>. E.g. wan dlci 16
ifOperStatus	This is the current operational status of the DLCI.
ifLastChange	This is the system-up time on the moment the DLCI entered its current operational state. I.e. the moment the value of the ifOperStatus element changes (from up to down or vice versa), the system-up time value is written into the ifLastChange element.
frameRelay	This displays the specific Frame Relay related status information of the DLCI. Refer to telindus1431Router/<modularIf>/frameRelay/dlciTable/frameRelay on page 599 for a detailed description of the frameRelay structure.

telindus1431Router/<modularIf>/frameRelay/dlciTable/frameRelay

The frameRelay structure in the dlciTable displays the specific Frame Relay related status information of the DLCI.

The frameRelay structure contains the following elements:

Element	Description
dlci	This is the DLCI identification number.
active	This indicates whether the corresponding DLCI is active (on) or not (off).
new	This is set to on if the DLCI has just been created, else it is off.
deleted	This is set to on if the DLCI has been deleted, else it is off.
rr	This element is only relevant for LMI revision 1. It is the flow control flag. If it is on, then no traffic can be sent on this DLCI. Else it is off.
bandwidth	This element is only relevant for LMI revision 1 (in all other cases this value is 0). It is the CIR value, in bps, as it is configured on the remote.
cllmLastCongestion-Cause	CLLM (Consolidated Link Layer Management) is a Frame Relay protocol used for traffic management. The cllmLastCongestionCause element indicates the last reason, which was received from the network, for congestion on the corresponding DLCI. Refer to telindus1431Router/<modularIf>/frameRelay/cllmLastCongestionCause on page 601 for the possible values of the cllmLastCongestionCause element.

telindus1431Router/<modularIf>/frameRelay/lmi

This attribute gives a complete LMI status information overview.

The lmi structure contains the following elements:

Element	Description
mode	This displays the Frame Relay mode. Possible values are: noLmi, user, network, auto. Refer to telindus1431Router/<modularIf>/frameRelay/lmi on page 429 for more information on these values.
type	This displays the LMI variant. Possible values are: lmiRev1, ansiT1-617-d, q933-Annex-A, frf1-2. Refer to telindus1431Router/<modularIf>/frameRelay/lmi on page 429 for more information on these values.
status	This displays the current state of LMI. Possible values are: • up. LMI messages can and are exchanged. • down. No LMI messages can be exchanged.
lastStatusChange	This is the system-up time when the LMI status entered its current state. I.e. the moment the value of the status element changes (from up to down or vice versa), the system-up time value is written into the lastStatusChange element.
lastError	This displays the last error condition reported by LMI. Possible values are: none, protocol error, unknown information element, sequence error, unknown report, timer expired, invalid report type, unsolicited status.
netTxSeqNum	This is the sequence number of the last LMI Status Response frame that was sent. Since only a Frame Relay network or DCE can transmit Status Responses, the value of this element only changes in case the Telindus 1431 SHDSL CPE is defined as a Frame Relay network or both user and network. I.e. in case the mode element is set to network, auto or nni.
netRxSeqNum	This is the sequence number of the last LMI Status Enquiry frame that was received. Since only a Frame Relay network or DCE can receive Status Enquiries, the value of this element only changes in case the Telindus 1431 SHDSL CPE is defined as a Frame Relay network or both user and network. I.e. in case the mode element is set to network, auto or nni.
netErrors	This is the number of errors on LMI commands issued by the Frame Relay network or DCE during the last monitoredEvents period.
userTxSeqNum	This is the sequence number of the last LMI Status Enquiry frame that was sent. Since only a Frame Relay user or DTE can transmit Status Enquiries, the value of this element only changes in case the Telindus 1431 SHDSL CPE is defined as a Frame Relay user or both user and network. I.e. in case the mode element is set to user, auto or nni.

Element	Description
userRxSeqNum	This is the sequence number of the last LMI Status Response frame that was received. Since only a Frame Relay user or DTE can receive Status Responses, the value of this element only changes in case the Telindus 1431 SHDSL CPE is defined as a Frame Relay user or both user and network. I.e. in case the mode element is set to user, auto or nni.
userErrors	This is the number of errors on LMI commands issued by the Frame Relay user or DTE during the last monitoredEvents period.
userWaitFullEnquiry	This is the number of LMI frames still to be sent before a Full Status Enquiry will be requested.
userLastReport-TypeSent	This displays the type of the most recent report that was sent. Possible values are: • full status. The last report contained the full status. • link integrity. The last report only contained the link integrity information.

telindus1431Router/<modularIf>/frameRelay/cIlmLastCongestionCause

This attribute indicates the last reason, which was received from the network, for congestion on any of the DLCIs. Possible values are:

- none
- short term, excessive traffic
- long term, excessive traffic
- short term, equipment failure
- long term, equipment failure
- short term, maintenance action
- long term, maintenance action
- short term, unknown cause
- long term, unknown cause
- unknown cause

15.5.3 CES status attributes

This section describes the following status attributes:

- telindus1431Router/<modularIf>/ces/state on page 603
- telindus1431Router/<modularIf>/ces/outstandingCells on page 606

telindus1431Router/<modularIf>/ces/state

This attribute shows the state of the Sequence Number (SN) processing.

The SN processing handles lost and misinserted cells. It detects these lost or misinserted cells and replaces this lost information using dummy cells.

The Telindus 1431 SHDSL CPE uses the Robust SN algorithm for its SN processing. A decision in this algorithm is taken after the analysis of two consecutive SNs. This means that when a cell is received, it is stored, waiting for the next one before it is eventually passed to the final destination. In the state machine, the action always refers to the stored cell.

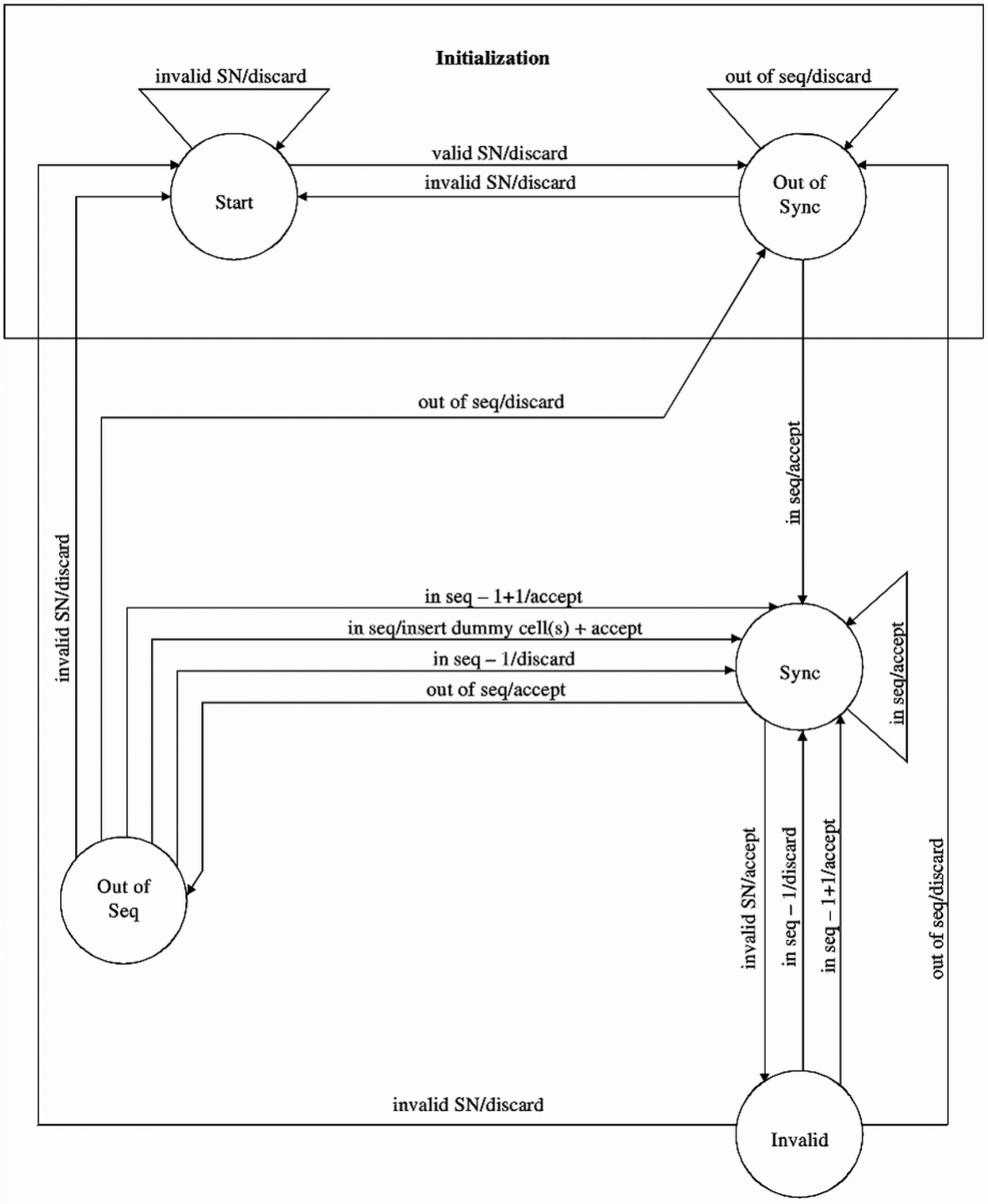
A valid SN is defined as an SN which has no detected errors or had an error that was corrected.

Possible values of the state attribute are:

Value	Description
start	It is the initial state. It remains in this state discarding the cells until there is a valid SN.
outOfSync	In this state, the sequence counting is not synchronised yet. It waits for a Sequence Count (SC) that is in sequence with the previous one. When it occurs, the stored cell is accepted by the system. If a cell with an invalid SN is received, the system returns to start and the stored cell is discarded.
sync	In this state, the sequence counting is considered to be synchronised: • If the SC is in sequence with the previous one, it remains in this state and the stored cell is accepted. • If the SN is invalid, it goes to invalid, but the stored cell is accepted. • If the SC is not in sequence with the previous one, it goes to outOfSequence, accepting the stored cell.
invalid	In this state, the system shall take a decision on the stored cell with the invalid SN, when it receives the next cell: • If the SN is again invalid, the system returns to start and the stored cell is discarded. • If the SN is valid and the SC is in sequence with the last cell received with a valid SN, the system returns to sync, but the stored cell is considered to be misinserted and it is discarded. • If the SN is valid but the SC has a value exceeding by two the SC of the last cell received with a valid SN, it is assumed that although there was an invalid SN the stored cell is in sequence and therefore it is accepted. It returns to sync. • If the SN is valid but is not in any of the previous situations, it discards the stored cell and goes to outOfSync.

Value	Description
outOfSequence	In this state the following actions are taken when a cell arrives: • If the SN is invalid, it discards the stored cell and it goes to start. • If the SN is valid and the SC is in sequence with the last cell received prior to the stored one, the system returns to sync, but the stored cell is considered to be misinserted and is discarded. • If the SN is valid and the SC is in sequence with the SC of the stored cell, the system assumes that cells were lost; it inserts a number of dummy cells identical to the number of lost cells, accepts the stored cell and returns to sync. • If the SN is valid and the SC has a value exceeding by two the SC of the last cell received prior to the stored cell, the system assumes that the stored cell was in sequence (i.e. the SN error protection mechanism failed) and therefore it accepts the stored cell and returns to sync. • If the SN is valid but is not in any of the two previous situations, it discards the stored cell and goes to outOfSync.

The following shows a drawing of the SN processing states. An evolution in the state machine is indicated by an arc, on which there are two distinct values represented. The first value refers to the event that originates the evolution in the state machine, and the second value refers to an action to be taken as a result of the event.



For more detailed information refer to the ITU-T recommendation I.363.1, Appendix III: Informative and example operations for handling of lost/misinserted cells and for maintaining bit count integrity.

telindus1431Router/<modularIf>/ces/outstandingCells

This attribute displays the number of cells that are present in the ATM cell buffer. Refer to telindus1431Router/<modularIf>/ces/maxCellVariation on page 435 for more information on this buffer.

This number can vary between 1 and two times the number you configured in the maxCellVariation attribute. So if you configured 4 as maxCellVariation value, then the outstandingCells value can vary between 1 and 8.

In case the outstandingCells value is …

- 1, then the buffer underruns. This can be the result of, for example, cell losses or cell discards. In this case, dummy cells are inserted.
- 2 x maxCellVariation, then the buffer overruns. This can be the result of, for example, a too high ATM cell rate (filling the buffer) and a too low interface speed (emptying the buffer). In this case, cells have to be discarded.

15.5.4 PPPoA status attributes

This section describes the following status attributes:

- telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/lcpState on page 608
- telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/ipcpState on page 608
- telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/bcpState on page 608
- telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/ccpState on page 608
- telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/myCompressionRatio on page 608
- telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/hisCompressionRatio on page 608
- telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/myAuthenticationStatus on page 609
- telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/hisAuthenticationStatus on page 609

telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/lcpState

This attribute reflects the status of the LCP (Link Control Protocol) protocol. Possible values are:

Value	Description
Initial	LCP handshake has not started yet.
Starting, Closed, Stopped, Closing, Stopping	These values correspond with the transient states in the LCP state diagram.
Req-Sent	The local side of the PPP link has sent an LCP request. The remote side did not answer yet.
Ack-Rcvd	The local side of the PPP link has received an LCP acknowledge from the remote side. This is a transient state.
Ack-Sent	The local side of the PPP link has acknowledged the LCP request from the remote side.
Opened	The LCP handshake succeeded.

telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/ipcpState

This attribute reflects the status of the IPCP (Internet Protocol Control Protocol) protocol. The possible values are the same as those of the lcpState attribute.

Refer to telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/lcpState on page 608.

telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/bcpState

This attribute reflects the status of the BCP (Bridging Control Protocol) protocol. The possible values are the same as those of the lcpState attribute.

Refer to telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/lcpState on page 608.

telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/ccpState

This attribute reflects the status of the CCP (Compression Control Protocol) protocol. The possible values are the same as those of the lcpState attribute.

Refer to telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/lcpState on page 608.

telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/myCompressionRatio

When PPP compression is enabled, this attribute displays the compression ratio achieved by the router at this side (local side) of the link.

telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/hisCompressionRatio

When PPP compression is enabled, this attribute displays the compression ratio achieved by the router at the other side (remote side) of the link.

telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/myAuthenticationStatus

This attribute displays the authentication state of the router at this side (local side) of the link. I.e. the state of the authenticator. Possible values are:

Value	Description
No-Authentication	The local side does not request PPP authentication or still has to start the CHAP authentication (LCP handshake is busy).
Wait-On-Response	The local side has sent a challenge packet and is waiting for an answer.
Authen-Successful	The response packet is found to be correct. This is the state when authentication succeeded.
Authen-Failure	The response packet is found to be incorrect. This is a transient state since the router starts the LCP handshake again after a failing authentication.

telindus1431Router/wanInterface/atm/pvcTable/atm/ppp/hisAuthenticationStatus

This attribute displays the authentication state of the router at the other side (remote side) of the link. I.e. the state of the peer. Possible values are:

Value	Description
No-Authentication	This is the start-up state.
Wait-On-Challenge	During the LCP handshake the authenticator already indicates it wants to authenticate. From that moment on, the peer awaits a challenge packet.
Wait-On-Success	Once the peer has sent a response, it awaits a success or failure message.
Authen-Successful	The peer has received a success packet. It remains in this state during data transfer.
Authen-Failure	The peer has received a failure packet. This is a transient state since the router starts the LCP handshake again after a failing authentication.
Authen-Not-Allowed	This state only occurs when the peer does not accept the authentication request during the LCP handshake. A possible reason might be that the peer router does not support CHAP.

15.6 SHDSL line status attributes

This section describes the following line status attributes:

- telindus1431Router/wanInterface/line/ifDescr on page 611
- telindus1431Router/wanInterface/line/ifType on page 611
- telindus1431Router/wanInterface/line/ifOperStatus on page 611
- telindus1431Router/wanInterface/line/ifSpeed on page 611
- telindus1431Router/wanInterface/line/region on page 611
- telindus1431Router/wanInterface/line/maxSpeedSearch on page 611
- telindus1431Router/wanInterface/line/maxSpeedResult on page 611
- telindus1431Router/wanInterface/line/linePairsSwapped on page 612
- telindus1431Router/wanInterface/line/eocAlarmThresholds on page 612
- telindus1431Router/wanInterface/line/testType on page 613
- telindus1431Router/wanInterface/line/testStatus on page 613
- telindus1431Router/wanInterface/line/testOriginator on page 613

This section describes the following line pair status attributes:

- telindus1431Router/wanInterface/line/linePair[ ]/ifOperStatus on page 616
- telindus1431Router/wanInterface/line/linePair[ ]/ifSpeed on page 616
- telindus1431Router/wanInterface/line/linePair[ ]/status on page 616
- telindus1431Router/wanInterface/line/linePair[ ]/timeSinceLastRetrain on page 616
- telindus1431Router/wanInterface/line/linePair[ ]/lineAttenuation on page 616
- telindus1431Router/wanInterface/line/linePair[ ]/signalNoise on page 616
- telindus1431Router/wanInterface/line/linePair[ ]/transmitPower on page 616
- telindus1431Router/wanInterface/line/linePair[ ]/actualBitRate on page 617

This section describes the following actions:

- telindus1431Router/wanInterface/line/maximumSpeedSearch on page 614
- telindus1431Router/wanInterface/line/testActivation on page 615

telindus1431Router/wanInterface/line/ifDescr

This attribute displays the interface description.

telindus1431Router/wanInterface/line/ifType

This attribute displays the interface type.

telindus1431Router/wanInterface/line/ifOperStatus

This attribute displays the current operational status of the line. Possible values are:

Value	Description
up	The line is up, data transfer is possible.
down	The line is down, data transfer is not possible.
testing	A line test is active.

telindus1431Router/wanInterface/line/ifSpeed

This attribute displays the current line speed in bits per second (bps).

In case of a Telindus 1431 SHDSL CPE 2 pair version, the line/ifSpeed attribute displays the sum of the speed of line pair 1 and 2.

telindus1431Router/wanInterface/line/region

This attribute displays the SHDSL standard currently used. Possible values are: auto, annexA, annexB. Refer to telindus1431Router/wanInterface/line/region on page 444 for more information on these values.

telindus1431Router/wanInterface/line/maxSpeedSearch

This attribute displays the status of the maximumSpeedSearch action. Possible values are:

Value	Description
idle	No maximumSpeedSearch action has been performed.
progressing	The maximumSpeedSearch action is running.
aborted	The maximumSpeedSearch action stopped without result.
completed	The maximumSpeedSearch action is finished. The result is displayed in the maxSpeedResult attribute.

telindus1431Router/wanInterface/line/maxSpeedResult

This attribute displays the maximum speed, in bits per second (bps), that was achieved during the execution of the maximumSpeedSearch action.

telindus1431Router/wanInterface/line/linePairsSwapped

This attribute is only present on the Telindus 1431 SHDSL CPE 2 pair version.

This attribute indicates whether the line pairs have been swapped when connecting the central with the remote device. Possible values are:

Value	Description
yes	The line pairs are swapped.
no	The line pairs are not swapped.
unknown	The Telindus 1431 SHDSL CPE is unable to determine whether the line pairs have been swapped (e.g. because it is still training).

telindus1431Router/wanInterface/line/eocAlarmThresholds

What this attribute displays depends on the setting of the telindus1431Router/wanInterface/line/eocHandling attribute:

If eocHandling **is set to …**	**then …**
none	the eocAlarmThresholds attribute does not display relevant information. It always displays 0.0.
discovery inventory info	• on the central[1] device, the eocAlarmThresholds attribute displays the values as set in the telindus1431Router/wanInterface/line/linkAlarmThresholds attribute. • on the remote[2] device, the eocAlarmThresholds attribute does not display relevant information. It always displays 0.0.
alarmConfiguration	the eocAlarmThresholds attribute displays the values as set in the telindus1431Router/wanInterface/line/linkAlarmThresholds attribute on the central device.

1. The central device is the device on which the channel attribute is set to central.
2. The remote device is the device on which the channel attribute is set to remote.

The eocAlarmThresholds structure contains the following elements:

- lineAttenuation
- signalNoise

telindus1431Router/wanInterface/line/testType

This attribute displays which line test is currently active.

Refer to telindus1431Router/wanInterface/line/testActivation on page 615 for more information on line tests.

telindus1431Router/wanInterface/line/testStatus

This attribute displays the status of the active line test. Possible values are:

Value	Description
progressing	The test is starting.
running	The test is running.
ending	The test is ending.
unknown	There are two possibilities: • No test is running. • For some reason it is not possible to retrieve the status of the test.

Refer to telindus1431Router/wanInterface/line/testActivation on page 615 for more information on line tests.

telindus1431Router/wanInterface/line/testOriginator

This attribute displays the origin of the active line test. Possible values are:

Value	Description
nms	The test is initiated by the management system (e.g. TMA, ATWIN, CLI, etc.).
interface	The test is initiated by the application, through one of the E1 interfaces.
remote	The test is initiated by a remote device (e.g. a Crocus SHDSL connected to the Telindus 1431 SHDSL CPE).
unknown	There are two possibilities: • No test is running. • For some reason it is not possible to define the origin of the test.

Refer to telindus1431Router/wanInterface/line/testActivation on page 615 for more information on line tests.

telindus1431Router/wanInterface/line/maximumSpeedSearch

Use this action to determine the highest possible line speed that can be achieved between the central and remote Telindus 1431 SHDSL CPE.

When you execute this test, the following happens:

Phase	Action
1	The Telindus 1431 SHDSL CPE interrupts the normal data transfer.
2	Both local and remote Telindus 1431 SHDSL CPE go to auto speed mode in order to determine the highest possible line speed. Meanwhile, the status of the test can be monitored with the maxSpeedSearch attribute.
3	When the test ends, the result is displayed by the maxSpeedResult attribute.
4	The Telindus 1431 SHDSL CPE resumes normal data transfer at the speed that was selected before the test.

Important remarks

- The Telindus 1431 SHDSL CPE has to be in data state (i.e. after a successful training sequence and when the data connection is up) before you can execute the maximumSpeedSearch action.
- While the maximumSpeedSearch action is running, no data transmission is possible.
- In case of a Telindus 1431 SHDSL CPE 2 pair version, you can not execute the maximumSpeedSearch action because you can not define a speed range on both the central and remote Telindus 1431 SHDSL CPE.

telindus1431Router/wanInterface/line/testActivation

Use this action to activate a test on the line interface of the Telindus 1431 SHDSL CPE. These tests are useful to trace possible problems. First select a test (i.e. an argument value), then execute the testActivation action.

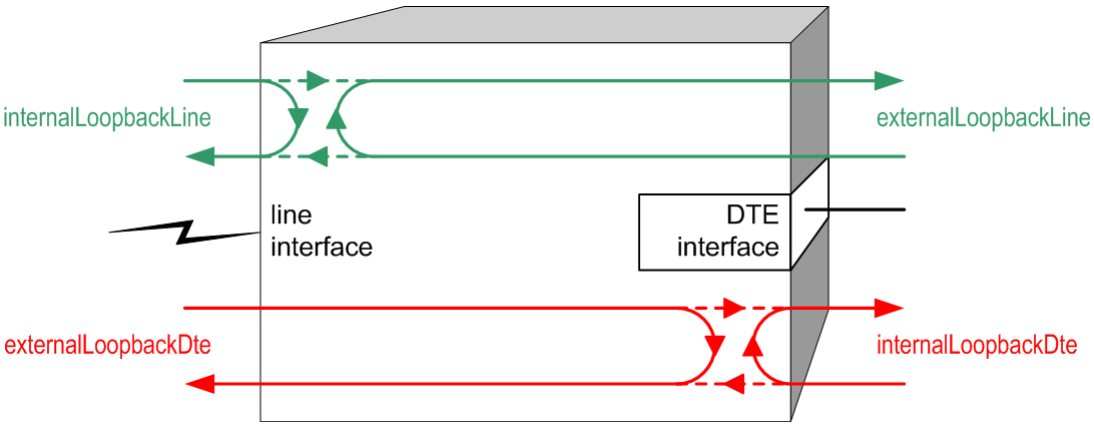
The testActivation action has the following argument values:

Value	Description
no	No test is activated. In case you want to stop a test, then select this value and execute the testActivation action.
externalLoopbackLine	The data coming from the DTE is looped back to the DTE at line interface level.
internalLoopbackLine	The data coming from the remote side is looped back to the remote side at line interface level.

If a test is running, then deactivate this test before starting a new test.

You can also activate tests on the modular user interface. Refer to telindus1431Router/<modularIf>/testActivation on page 625.

The following figure gives an overview of the different tests:



telindus1431Router/wanInterface/line/linePair[ ]/ifOperStatus

This attribute displays the current operational status of the line pair. Possible values are:

Value	Description
up	The line pair is up, data transfer is possible. This is the case when the value of the linePair[ ]/status attribute is dataState.
down	The line pair is down, data transfer is not possible.
testing	A line test is active.

telindus1431Router/wanInterface/line/linePair[ ]/ifSpeed

This attribute displays the line pair speed, in bits per second (bps), when the line pair is in data state.

telindus1431Router/wanInterface/line/linePair[ ]/status

This attribute displays the current status of the line pair. Possible values are:

Value	Description
idle	No link is present.
training	A training cycle is in progress.
dataState	A data link is present.

telindus1431Router/wanInterface/line/linePair[ ]/timeSinceLastRetrain

This attribute displays the elapsed time since the last retrain cycle.

telindus1431Router/wanInterface/line/linePair[ ]/lineAttenuation

This attribute displays the current line pair attenuation in dB.

The lineAttenuation attribute does not display meaningful information when the line is not trained. It is only relevant for a line that is in data state for at least 5 minutes.

telindus1431Router/wanInterface/line/linePair[ ]/signalNoise

This attribute displays the current signal to noise ratio on the line pair in dB.

The signalNoise attribute does not display meaningful information when the line is not trained. It is only relevant for a line that is in data state for at least 5 minutes.

telindus1431Router/wanInterface/line/linePair[ ]/transmitPower

This attribute displays the transmit power on the line pair in dB.

telindus1431Router/wanInterface/line/linePair[ ]/actualBitRate

This attribute displays the maximum speed, in bits per second (bps), that could be negotiated on the line pair during the training sequence.

15.7 End status attributes

This section describes the following status attributes:

- telindus1431Router/wanInterface/end/vendorId on page 619
- telindus1431Router/wanInterface/end/vendorModel on page 619
- telindus1431Router/wanInterface/end/vendorSerial on page 619
- telindus1431Router/wanInterface/end/vendorSoftVersion on page 619
- telindus1431Router/wanInterface/end/eocSoftVersion on page 619
- telindus1431Router/wanInterface/end/shdslVersion on page 619
- telindus1431Router/wanInterface/end/eocState on page 620
- telindus1431Router/wanInterface/end/eocAlarmThresholds on page 620
- telindus1431Router/wanInterface/end/linePair[ ]/lineAttenuation on page 620
- telindus1431Router/wanInterface/end/linePair[ ]/signalNoise on page 620

- Exactly which information is retrieved from the remote SHDSL device(s) through the EOC channel depends on the setting of the eocHandling attribute. Refer to 5.4.4 - Which standard EOC information is retrieved? on page 76 for an overview.

telindus1431Router/wanInterface/end/vendorId

This attribute is only retrieved in case the eocHandling attribute is set to discovery, inventory, info or alarmConfiguration.

This attribute displays information about the vendor of the repeater or end device. The vendorId structure contains the following elements:

- countryCode E.g. 65295 for Belgium.
- providerCode E.g. TLS_ for Telindus.
- vendorSpecific

telindus1431Router/wanInterface/end/vendorModel

This attribute is only retrieved in case the eocHandling attribute is set to inventory, info or alarmConfiguration.

This attribute displays the model of the repeater or end device. E.g. SHDSL TT 2P for a Crocus SHDSL Table Top 2 pair version.

telindus1431Router/wanInterface/end/vendorSerial

This attribute is only retrieved in case the eocHandling attribute is set to inventory, info or alarmConfiguration.

This attribute displays the serial number of the repeater or end device. For a Telindus devices this is the deviceId attribute (refer to telindus1431Router/deviceId on page 577).

telindus1431Router/wanInterface/end/vendorSoftVersion

This attribute is only retrieved in case the eocHandling attribute is set to inventory, info or alarmConfiguration.

This attribute displays the version of the firmware used on the repeater or end device. For a Telindus device this is the part after "/" of the T-code string displayed in the flashVersion attribute (refer to telindus1431Router/flash1Version on page 575).

telindus1431Router/wanInterface/end/eocSoftVersion

This attribute is only retrieved in case the eocHandling attribute is set to discovery, inventory, info or alarmConfiguration.

This attribute displays the EOC software version used on the repeater or end device.

telindus1431Router/wanInterface/end/shdslVersion

This attribute is only retrieved in case the eocHandling attribute is set to discovery, inventory, info or alarmConfiguration.

This attribute displays the SHDSL version used on the repeater or end device.

telindus1431Router/wanInterface/end/eocState

This attribute is only retrieved in case the eocHandling attribute is set to discovery, inventory, info or alarmConfiguration.

This attribute displays the state of the EOC channel.

telindus1431Router/wanInterface/end/eocAlarmThresholds

This attribute is only retrieved in case the eocHandling attribute is set to info or alarmConfiguration.

What this attribute displays depends on the setting of the telindus1431Router/wanInterface/line/eocHandling attribute:

If eocHandling **is set to …**	**then …**
info	the eocAlarmThresholds attribute displays the values as set in the telindus1431Router/wanInterface/line/linkAlarmThresholds attribute on the remote[1] device.
alarmConfiguration	the eocAlarmThresholds attribute displays the values as set in the telindus1431Router/wanInterface/line/linkAlarmThresholds attribute on the central[2] device.

1. The remote device is the device on which the channel attribute is set to remote.
2. The central device is the device on which the channel attribute is set to central.

The eocAlarmThresholds structure contains the following elements:

- lineAttenuation
- signalNoise

telindus1431Router/wanInterface/end/linePair[ ]/lineAttenuation

This attribute is only retrieved in case the eocHandling attribute is set to info or alarmConfiguration.

This attribute displays the line attenuation, in dB, as it is measured on the line pair of the repeater or end device.

telindus1431Router/wanInterface/end/linePair[ ]/signalNoise

This attribute is only retrieved in case the eocHandling attribute is set to info or alarmConfiguration.

This attribute displays the noise margin, in dB, as it is measured on the line pair of the repeater or end device.

15.8 Modular user interface status attributes

This section discusses the status attributes of the modular user interfaces.

First it describes the status attributes that are common for both the G703 and serial interfaces. Then it describes the status attributes that specifically apply on the G703 interface. Following this, it describes the status attributes that specifically apply on the serial interface (RS530, V35, V36 and X21).

The following gives an overview of this section:

- 15.8.1 - Common status attributes on page 622
- 15.8.2 - G703 interface status attributes on page 626
- 15.8.3 - Serial interface status attributes on page 628

The status attributes of the encapsulation protocols that can be used on the modular user interfaces are explained in 15.5 - Encapsulation status attributes on page 589.

15.8.1 Common status attributes

This section describes the following status attributes:

- telindus1431Router/<modularIf>/ifDescr on page 623
- telindus1431Router/<modularIf>/ifType on page 623
- telindus1431Router/<modularIf>/ifOperStatus on page 623
- telindus1431Router/<modularIf>/ifLastChange on page 623
- telindus1431Router/<modularIf>/ifSpeed on page 623
- telindus1431Router/<modularIf>/ifMtu on page 623
- telindus1431Router/<modularIf>/ifClocking on page 624
- telindus1431Router/<modularIf>/testType on page 624
- telindus1431Router/<modularIf>/testStatus on page 624

This section describes the following actions:

- telindus1431Router/<modularIf>/testActivation on page 625

Depending on which type of modular user interface is used, the name of the modular user interface object (labelled <modularIf> in the following text) can be g703, g703/channel[g703_1], rs530, v35, v36 or x21.

telindus1431Router/<modularIf>/ifDescr

This attribute displays the interface description. Values are e.g. rs530, v35, x21, etc.

telindus1431Router/<modularIf>/ifType

This attribute displays the interface type. Values are e.g. frame-relay, ces, etc.

telindus1431Router/<modularIf>/ifOperStatus

This attribute displays the current operational status (up / down) of the interface.

In case of a …

- G703 interface the ifOperStatus attribute value is down if a Loss Of Signal (LOS) is detected.
- a serial interface (RS530, V35, V36 or X21) the ifOperStatus attribute …
  - follows the protocol (LMI) in case of FRF.
  - is always up in case of CES.

telindus1431Router/<modularIf>/ifLastChange

This attribute shows the system-up time on the moment the interface entered its current operational state. I.e. the moment the value of the ifOperStatus status attribute changes (from up to down or vice versa), the system-up time value is written into the ifLastChange status attribute.

telindus1431Router/<modularIf>/ifSpeed

This attribute displays the interface speed in bits per second (bps).

telindus1431Router/<modularIf>/ifMtu

This attribute displays the interface its Maximum Transfer Unit, i.e. the maximum number of bytes that one packet can contain on this interface.

telindus1431Router/<modularIf>/ifClocking

This attribute displays the clocking mode which is actually used by the Telindus 1431 SHDSL CPE, e.g. slaveOnNetworkPreferred.

This is not necessarily the clocking mode you configured. It can be a clocking mode that is selected by the Telindus 1431 SHDSL CPE because it was not possible to select the clocking mode of your choice (for example, because the external clock signal is lost).

telindus1431Router/<modularIf>/testType

This attribute displays which interface test is currently active.

Refer to telindus1431Router/<modularIf>/testActivation on page 625 for more information on interface tests.

telindus1431Router/<modularIf>/testStatus

This attribute displays the status of the active interface test. Possible values are:

Value	Description
progressing	The test is starting.
running	The test is running.
ending	The test is ending.
unknown	There are two possibilities: • No test is running. • For some reason it is not possible to retrieve the status of the test.

Refer to telindus1431Router/<modularIf>/testActivation on page 625 for more information on interface tests.

telindus1431Router/<modularIf>/testActivation

Use this action to activate a test on the modular user interface of the Telindus 1431 SHDSL CPE. These tests are useful to trace possible problems. First select a test (i.e. an argument value), then execute the testActivation action.

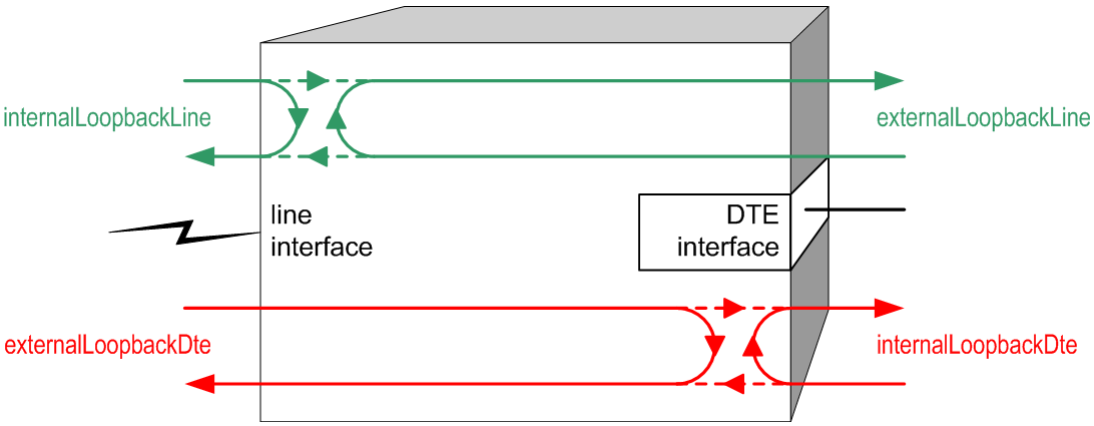
The testActivation action has the following argument values:

Value	Description
no	No test is activated. In case you want to stop a test, then select this value and execute the testActivation action.
internalLoopback-Dte	The data coming from the DTE is looped back to the DTE at modular user interface level.
externalLoopback-Dte	The data coming from the remote side is looped back to the remote side at modular user interface level.

If a test is running, then deactivate this test before starting a new test.

You can also activate tests on the line interface. Refer to telindus1431Router/wanInterface/line/testActivation on page 615.

The following figure gives an overview of the different tests:



15.8.2 G703 interface status attributes

This section describes the following status attributes:

- telindus1431Router/g703/coding on page 627
- telindus1431Router/g703/los on page 627
- telindus1431Router/g703/lfa on page 627
- telindus1431Router/g703/ais on page 627
- telindus1431Router/g703/rai on page 627
- telindus1431Router/g703/channelTable on page 627

Refer to 15.8.1 - Common status attributes on page 622 for an explanation of the modular user interface common status attributes ifDescr, ifType, ifOperStatus, ifLastChange, ifSpeed and ifMtu.

telindus1431Router/g703/coding

This attribute displays which G.703 encoding mode is currently in use (ami or hdb3). Refer to telindus1431Router/g703/coding on page 459 for more information on the encoding modes.

telindus1431Router/g703/los

This attribute displays (on / off) whether a Loss Of Signal has been detected. LOS is on when the incoming data is no longer present. E.g. the connection *from* the DTE *towards* the Telindus 1431 SHDSL CPE is interrupted.

telindus1431Router/g703/lfa

This attribute displays (on / off) whether a Loss of Frame Alignment has been detected. LFA is on when the Frame Alignment Signal (FAS), which is present in time slot 0 of the G.704 framed data, is not detected after a certain period.

telindus1431Router/g703/ais

This attribute displays (on / off) whether an Alarm Indication Signal has been detected. AIS is on when the AIS signal (also called *all ones*) is detected on the incoming data. AIS means there is an alarm occurring on the line upstream from the equipment that is connected to the G.703 interface.

telindus1431Router/g703/rai

This attribute displays (on / off) whether a Remote Alarm Indication signal has been detected. RAI is on when the RAI signal is detected on the incoming data. RAI means the far-end equipment has a problem with the signal it is receiving from the local equipment.

telindus1431Router/g703/channelTable

This attribute displays which time slots are enabled on which logical channels.

Refer to 5.6 - Adding CES channels on the G703 interface on page 82 for more information on logical channels.

telindus1431Router/g703/jitterAttenuator

This attribute displays the jitter direction and depth as it is configured.

15.8.3 Serial interface status attributes

This section describes the following status attributes:

- telindus1431Router/<modularIf>/txdItu103 on page 629
- telindus1431Router/<modularIf>/rxdItu104 on page 629
- telindus1431Router/<modularIf>/rtsItu105 on page 629
- telindus1431Router/<modularIf>/ctsItu106[3] on page 629
- telindus1431Router/<modularIf>/dsrItu107[3] on page 629
- telindus1431Router/<modularIf>/dcdItu109[3] on page 629
- telindus1431Router/x21/indicator on page 629

- Depending on which type of serial interface is used, the name of the serial interface object (labelled <serialIf> in the following text) can be rs530, v35, v36 or x21.
- Refer to 15.8.1 - Common status attributes on page 622 for an explanation of the common modular user interface status attributes ifDescr, ifType, ifOperStatus, ifLastChange, ifSpeed and ifMtu.

telindus1431Router/<modularIf>/txdItu103

This attribute displays the status (on / off) of the transmit data signal (circuit 103). The txdItu103 attribute only indicates the presence of the TxD signal, it does not monitor the real data signal.

telindus1431Router/<modularIf>/rxdItu104

This attribute displays the status (on / off) of the receive data signal (circuit 104). The rxdItu104 attribute only indicates the presence of the RxD signal, it does not monitor the real data signal.

telindus1431Router/<modularIf>/rtsItu105[3]

This attribute displays the status (on / off) of the request to send signal (circuit 105).

telindus1431Router/<modularIf>/ctsItu106[3]

This attribute displays the status (on / off) of the clear to send signal (circuit 106).

telindus1431Router/<modularIf>/dsrItu107[3]

This attribute displays the status (on / off) of the data set ready signal (circuit 107).

telindus1431Router/<modularIf>/dcdItu109[3]

This attribute displays the status (on / off) of the data carrier detect signal (circuit 109).

telindus1431Router/x21/indicator[4]

This attribute displays the status (on / off) of the indicator signal.

3. RS530, V35 and V36 only
4. X21 only

15.9 Router status attributes

This section discusses the status attributes concerned with routing. First it describes the general routing status attributes. Then it explains the status attributes of the extra features as there are NAT, L2TP tunnelling, etc…

The following gives an overview of this section:

- 15.9.1 - General router status attributes on page 631
- 15.9.2 - NAT status attributes on page 641
- 15.9.3 - L2TP tunnel status attributes on page 643
- 15.9.4 - OSPF status attributes on page 648
- 15.9.5 - VRRP status attributes on page 666

15.9.1 General router status attributes

This section describes the following status attributes:

- telindus1431Router/router/routingTable on page 632
- telindus1431Router/router/igmpTable on page 635
- telindus1431Router/router/dhcpBinding on page 637
- telindus1431Router/router/dhcpStatistics on page 637
- telindus1431Router/router/dhcpRelayInfo on page 638
- telindus1431Router/router/dhcpBlackList on page 638
- telindus1431Router/router/radius on page 639
- telindus1431Router/router/dns on page 639
- telindus1431Router/router/dnsServers on page 639

This section describes the following actions:

- telindus1431Router/router/unBlacklist on page 639

telindus1431Router/router/routingTable

This attribute lists *all* known routes (both static and learned routes) with their operating status.

The routingTable contains the following elements:

Element	Description
network	This is the IP address of the destination network.
mask	This is the network mask of the destination network.
gateway	This is the IP address of the next router on the path to the destination network.
interface	This is the interface through which the destination network can be reached. Possible values are: • internal. The own protocol stack is used. • <name>. The destination network can be reached through this particular interface. The <name> of the interface is the name as you configured it. Note that the “interface” can also be a DLCI, an ATM PVC, a tunnel, etc. • discard. Packets for this destination are discarded.
encapsulation	This is the used encapsulation. It is related to the interface for this route. Possible values are: • none. The IP packets are not encapsulated. • ethernet. The IP packets are encapsulated with the ARPA MAC header. • frameRelay. The IP packets are encapsulated in Frame Relay. • ppp. The IP packets are encapsulated in PPP. • atm. The IP packets are encapsulated in ATM.

Element	Description
status	This is the route status. Possible values are: • up. The route is up, data transfer is possible. • down. The route is down, data transfer is not possible. • discard. Packets for this destination are discarded. • spoofing. This applies on routes over an ISDN/PSTN dial-up connection or through an L2TP outgoing dial tunnel. It means that the route is available, but that it is not truly up (yet). I.e. the (dial) connection can be made, but is currently not up. As soon as a connection is established, then the status of the route changes from spoofing to up. • holdDown. This applies on RIP routes. A route enters into a hold-down state when an update packet is received that indicates the route is unreachable. The route is marked inaccessible and advertised as unreachable. However, the route is still used for forwarding packets. When hold-down expires, routes advertised by other sources are accepted and the route is no longer inaccessible. Refer to telindus1431Router/router/ripHoldDownTime on page 473 for more information. • closed. This applies on L2TP tunnels and VRRP. In case of … - L2TP tunnels where you configure a main and a backup tunnel (refer to 12.4.4 - Setting up a main and back-up tunnel on page 323) and the main tunnel goes down, then it is not desirable that the route to the main tunnel its status returns from up to spoofing because in that case the Telindus 1431 SHDSL CPE will keep trying to send data across the main route/tunnel. That is why in such a case the route to the main tunnel is “artificially” blocked. I.e. its status is set to closed. - VRRP (refer to 10.9 - Configuring VRRP on page 253), it is sometimes desirable that the IP address on an Ethernet interface no longer answers to pings, even if the Ethernet interface is up. That is why in such a case the host route is “artificially” blocked. I.e. its status is set to closed.
preference	This displays the route preference. If more than one route matches the IP destination address, this attribute determines which route is used. The route with the lowest preference value will be used.
type	This is the type of the route. Possible values are: • host. This is a host route, i.e. a route to a single IP address instead of a complete network. This is also used for the router its own IP address. • internal. A route with this status is irrelevant. • local. This is a route to a directly connected network. • rip. This is a route that has been received via a RIP update. • static. This is a route that has been configured, i.e. it is a static route. • float. This is a route that has been added for a PPP link for which no local or remote IP address was configured. These were learned from the other side. Refer to 9.4.4 - Imposing IP addresses on the remote in PPP on page 174 for more information.

Element	Description
metric	If two routes exist with the same preference, then the route with the lowest metric value is chosen. The metric attribute serves as a cost for using the route. In most cases it indicates the number of hops (= routers) required to reach a destination.
timeOut	In case of a RIP route, the timeOut attribute displays the time the route will remain in the routing table if no RIP updates are received anymore. For other routes this attribute always displays 00000d 00h 00m 00s.

Example

The following figure displays an example of a routing table:

routingTable

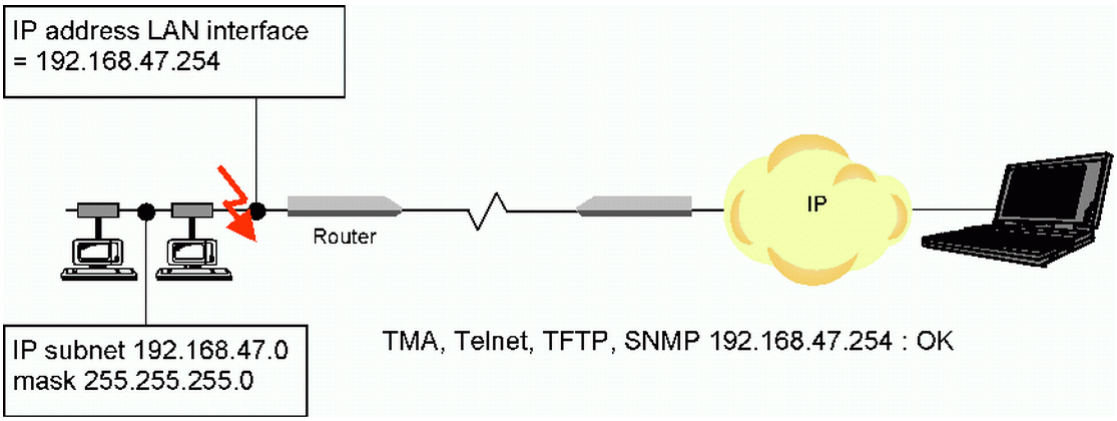
	network	mask	gateway	interface	encapsulation	status	preference	type	metric	timeout
1	0.0.0.0	0.0.0.0	127.0.0.1	discard	none	discard	255	internal	0	00000d 00h 00m 00s
2	192.168.47.0	255.255.255.0	192.168.47.254	lan	ethernet	up	1	local	1	00000d 00h 00m 00s
3	192.168.47.254	255.255.255.255	127.0.0.1	internal	none	up	1	host	0	00000d 00h 00m 00s
4	224.0.0.9	255.255.255.255	127.0.0.1	internal	none	up	1	host	0	00000d 00h 00m 00s
5	192.168.100.0	255.255.255.0	192.168.100.1	wan	ppp	down	1	local	1	00000d 00h 00m 00s
6	192.168.100.1	255.255.255.255	127.0.0.1	internal	none	down	1	host	0	00000d 00h 00m 00s
7	192.168.48.0	255.255.255.0	192.168.100.2	wan	ppp	down	10	static	1	00000d 00h 00m 00s

The lines in the routing table depicted above represent the following:

- Line 1 represents the default gateway, which is not defined.
- Lines 2 and 5 represent the subnets on the LAN and WAN interface respectively.
- Lines 3 and 6 represent the interface its IP addresses.
- Line 7 represents the static route to the remote LAN.
- Finally, line 4 represents the multicast address for RIP version 2.

Remark

If the LAN is not connected to the Telindus 1431 SHDSL CPE, it is still possible to contact the Telindus 1431 SHDSL CPE with e.g. TMA or Telnet over the WAN link by using the IP address of the LAN interface. This means that the status attribute telindus1431Router/lanInterface/ip/status still indicates up, although in the routingTable the corresponding route to the network is down. This implementation seems not logical but is necessary to insure correct operation with HP OpenView.



telindus1431Router/router/igmpTable

This attribute shows the multicast address, reported by one or more clients. The igmpTable is always updated, even if no proxy is configured.

The igmpTable contains the following elements:

Element	Description
multicast	This is the multicast address.
interface	This is the interface name of the client(s). In case of multiple interface names, they are separated from each other by a comma.

What is IGMP?

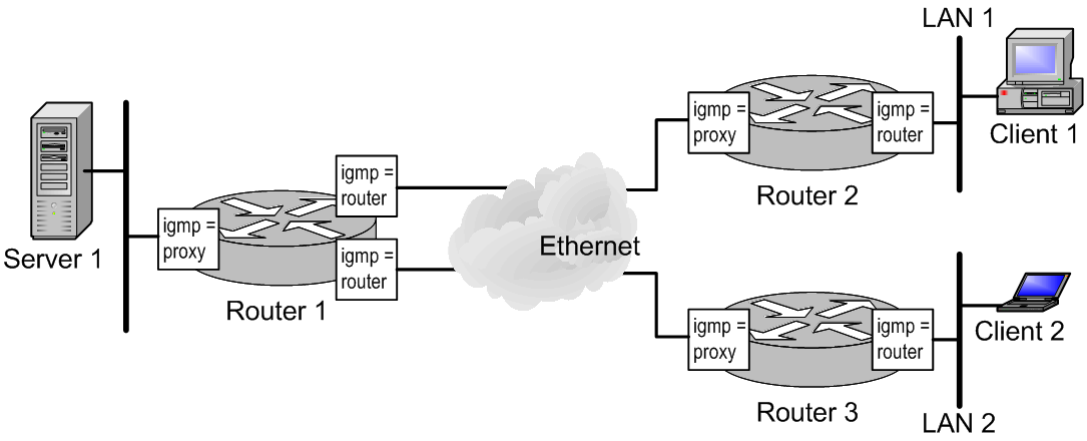
Internet Group Management Protocol (IGMP) is defined in RFC 1112 as the standard for IP multicasting in the Internet.

It is used to establish host memberships in particular multicast groups on a single network. The mechanisms of the protocol allow a host to inform its local router, using Host Membership Reports, that it wants to receive messages addressed to a specific multicast group.

All hosts conforming to level 2 of the IP multicasting specification require IGMP.

IGMP topology

Consider the following multicasting topology:



In this topology …

- Client 1 and Client 2 are multicast clients.
- Router 1, 2 and 3 are multicast enabled routers.
- Server 1 is a multicast server.

The following are some characteristics of an IGMP topology:

- Only 1 IGMP proxy can be defined per device.
- The TTL of an IGMP frame is always 1. IGMP messages are never forwarded.
- An IGMP frame contains an IP router alert option.
- IGMPv1 routers may be present in the network.

The multicasting IGMP protocol can be configured on every IP interface. Refer to the igmp element in 5.2.3 - Explaining the ip structure on page 60.

A client can leave or join a multicast group by erasing or adding a multicast address from a table, defined in the client application. A list of multicast group addresses is maintained in the routers. The reported multicast addresses can be seen in the igmpTable. Refer to telindus1431Router/router/igmpTable on page 635.

On a router interface, IGMP join and leave messages are interpreted and the multicast member list is adapted accordingly. Multicast frames are forwarded if they are present in the multicast member list. On a proxy interface, IGMP join and leave messages are transmitted according to the multicast member list. Multicast frames are always forwarded.

Since IGMP is send in UDP (join/leave can be lost), the clients (proxies) are polled every 125 seconds:

- A general query is send to 224.0.0.1 (poll all systems).
- A leave group message is send to 224.0.0.2 (all routers).

telindus1431Router/router/dhcpBinding

This attribute contains a list of dynamically assigned (i.e. leased) IP addresses.

The dhcpBinding table contains the following elements:

Element	Description
ipAddress	This is the IP address that is dynamically assigned to a client.
macAddress	This is the MAC address of the client.
leaseTime	This is the remaining lease time.
hostName	This is the hostname of the client.
interface	This is the name of the interface on which the client has been bound.
state	This is the state of the lease. Possible values are leased and onHold.

telindus1431Router/router/dhcpStatistics

This attribute contains the statistics of all IP address ranges that have been specified in the configuration attribute telindus1431Router/router/dhcpDynamic.

The dhcpStatistics table contains the following elements:

Element	Description
startRange	Displays the IP start address of an IP address range.
endRange	Displays the IP end address of an IP address range.
interface	For the corresponding IP address range, this is the name of the interface on which the clients have been bound.
free	For the corresponding IP address range, this displays the number of IP addresses that are still free.
leased	For the corresponding IP address range, this displays the number of IP addresses that are leased.
hold	For the corresponding IP address range, this displays the number of IP addresses that are on hold.

During power-down of the DHCP server, some leased IP addresses can still be active. Because the duration of the power-down can not be known, all timer information about lease and hold time becomes meaningless. Therefore, the DHCP server incorporated in the Telindus 1431 SHDSL CPE sends a ping to all leased addresses after a warm boot. When the client responds to this ping, the DHCP server resets all timers to their default value and keeps the lease with this client.

telindus1431Router/router/dhcpRelayInfo

This attribute displays the status information of the DHCP relay process in case the Telindus 1431 SHDSL CPE is configured to act as DHCP relay agent.

The dhcpRelayInfo table contains the following elements:

Element	Description
sourceIntf	This is the name of the interface on which the DHCP request has been received.
mac	This is the MAC address of the client.
assignedIp	This is the IP address that has been dynamically assigned to the client by the remote DHCP server.
serverIp	This is the IP address of the remote DHCP server.
dhcpStatus	This is the status of the DHCP process. Possible values are: discover, offer, request, decline, ack, nack, release, inform, idle.
leaseTime	This is the remaining lease time.

telindus1431Router/router/dhcpBlackList

This attribute displays the MAC and IP address of blacklisted clients and the reason why they are on the black list.

The dhcpBlackList table contains the following elements:

Element	Description
ipAddress	This is the IP address of the blacklisted client.
macAddress	This is the MAC address of the blacklisted client.
reason	This is the reason why the client is on the black list. Possible values are: • arp. The ARP request probing indicated that the IP address is already in use by a client on the network. Refer to telindus1431Router/router/dhcpCheckAddress on page 483. • ping. The ICMP Echo Request (ping) probing indicated that the IP address is already in use by a client on the network. Refer to telindus1431Router/router/dhcpCheckAddress on page 483. • alienAck. Another DHCP server assigned an IP address to the client. • declined. The client explicitly declined the IP address that was assigned. • networkOrBroadcast. The DHCP server tried to assign a network or broadcast address to a client. This indicates that the IP address ranges in the DHCP server have been misconfigured.

telindus1431Router/router/radius

This attribute shows some RADIUS status information. Refer to What is RADIUS? on page 333 for more information.

The radius structure contains the following elements:

Element	Description
authServer	This is the IP address of the authentication server the Telindus 1431 SHDSL CPE is connected to.
acctServer	This is the IP address of the accounting server the Telindus 1431 SHDSL CPE is connected to.
pendingRequests	This is the amount of pending requests on these servers.

telindus1431Router/router/dns

This attribute shows some DNS status information. Refer to What is DNS? on page 776 for more information.

The dns table contains the following elements:

Element	Description
ipAddress	This is the IP address of the DNS server.
hostname	This is the hostname of the DNS server.
ttl	This is the time-to-live of the cached DNS data.
infiniteTimeOut	This indicates that the DNS record has an infinite TTL or at least longer than 24 days.

telindus1431Router/router/dnsServers

This attribute displays the IP address(es) of the DNS server(s) that have been configured or learned.

The dns table contains the following elements:

Element	Description
primaryDns	This is the IP address of the primary DNS server.
secondaryDns	This is the IP address of the secondary DNS server.

telindus1431Router/router/unBlacklist

This action removes an entry from the blacklist.

The unBlacklist action contains the following argument values:

Element	Description
startIp	Use this element to specify an IP address (range) that has to be removed from the blacklist. If you want to specify … • a single IP address, then just enter the IP address in the startIp element and leave the stopIp element at its default value (<opt>). • an IP address range, then enter the first IP address of the range in the startIp element and the last IP address of the range in the stopIp element.
stopIp	Use this element to specify the last IP address of an IP address range that has to be removed from the blacklist.
mac	Use this element to specify a MAC address of an entry that has to be removed from the blacklist.

15.9.2 NAT status attributes

This section describes the following status attributes:

• telindus1431Router/router/defaultNat/addresses on page 642

telindus1431Router/router/defaultNat/addresses

This attribute displays the status of each official IP address that is configured in the configuration attribute telindus1431Router/router/defaultNat/addresses.

The addresses table contains the following elements:

Element	Description
officialAddress	This is the official IP address as you entered it in the addresses configuration attribute.
privateAddress	This is the private IP address that is currently linked with the official IP address.
status	This is the status of the official IP address. Possible values are: • free. This official IP address is currently not in use. • fixed. This address has a pre-configured mapping between the official and private IP address. • allocated. This official IP address is currently assigned to a private IP address, but it is not fixed.
uses	This indicates how many sessions are currently used by this official IP address. If the attribute value becomes zero, the assigned official IP address becomes free again and can be assigned to another private IP address.

15.9.3 L2TP tunnel status attributes

This section describes the following status attributes:

- telindus1431Router/router/tunnels/l2tpTunnels on page 644
- telindus1431Router/router/tunnels/ipsecL2tpTunnels on page 645

telindus1431Router/router/tunnels/l2tpTunnels

This attribute displays status information of the L2TP tunnels.

The l2tpTunnels table contains the following elements:

Element	Description
name	This is the name of the tunnel as you configured it. If you did not configure a name, then this element displays: “tunnel” <local IP address of the tunnel>. E.g. tunnel 192.168.5.1
ifOperStatus	This displays the operational status of the tunnel. Possible values are: • up. The tunnel is up, data transfer is possible. • down. The tunnel is down, data transfer is not possible. • dormant. The tunnel is "stand-by". As soon as data has to be sent over the tunnel, control connect messages are exchanged and the operational status of the tunnel becomes up.
ifLastChange	This is the system-up time on the moment the tunnel entered its current operational state. I.e. the moment the value of the ifOperStatus status element changes (from up to down or vice versa), the system-up time value is written into the ifLastChange status element.
ip	This displays the IP information of the tunnel. Refer to telindus1431Router/wanInterface/atm/pvcTable/ip on page 592 for a detailed description of the ip structure.
bridging	This displays the bridging information of the tunnel. Refer to telindus1431Router/lanInterface/bridging on page 582 for a detailed description of the bridging structure.
l2tp	This displays the specific L2TP related status information of the tunnel. Refer to the telindus1431Router/router/tunnels/l2tpTunnels/l2tp on page 645 for a detailed description of the l2tp structure.
ppp	This displays the PPP information of the tunnel. Refer to 15.5.4 - PPPoA status attributes on page 607 for a detailed description of the elements in the ppp structure.

telindus1431Router/router/tunnels/l2tpTunnels/l2tp

The l2tp structure in the l2tpTunnels table displays the specific L2TP related status information of the tunnel.

The l2tp structure contains the following elements:

Element	Description
sendingSeqNum	In case sequence numbering on the data messages is enabled (dataChannelSequenceNumbering = on), then this displays the transmit data sequence numbers.
receivingSeqNum	In case sequence numbering on the data messages is enabled (dataChannelSequenceNumbering = on), then this displays the receive data sequence numbers.
l2tpType	This displays which L2TP server type the Telindus 1431 SHDSL CPE currently is: LAC or LNS. If you set the configuration attribute l2tpMode to auto, then the status attribute l2tpType displays the auto value until the Telindus 1431 SHDSL CPEs have mutually decided who will be the LAC and who the LNS.
controlState	This displays the states associated with the LNS or LAC control connection establishment. Refer to L2TP status - control states on page 646 for more information.
callState	This displays the states associated with the LNS or LAC incoming or outgoing calls. Refer to L2TP status - call states on page 646 for more information.
deliveryState	This displays the states associated with the LNS or LAC packet delivery. Refer to L2TP status - delivery states on page 647 for more information.
authenState	This displays the states associated with the LNS or LAC authentication. Refer to L2TP status - authentication states on page 647 for more information.

telindus1431Router/router/tunnels/ipsecL2tpTunnels

This attribute displays status information of the IPSEC L2TP tunnels.

The ipsecL2tpTunnels table contains the same elements as the l2tpTunnels table. Refer to telindus1431Router/router/tunnels/l2tpTunnels on page 644.

L2TP status - control states

The states associated with the LNS or LAC for control connection establishment are:

Value	Description
idle	No control connection is present. Both initiator and recipient start from this state. An initiator transmits a Start Control Connection Request, while a recipient remains in the idle state until receiving a Start Control Connection Request.
waitCtlReply	This is the state where a Start Control Connection Reply is awaited.
waitCtlConn	This is the state where a Start Control Connection Connected is awaited. Upon receipt, the challenge response is checked. The tunnel either is established, or is torn down if an authorisation failure is detected.
established	The control connection is established. An established connection may be terminated by either a local condition or the receipt of a Stop Control Connection Notification. The session then returns to the idle state.

L2TP status - call states

The states associated with the LNS or LAC incoming or outgoing calls are:

Value	Description
idle	No data is exchanged over the tunnel.
waitTunnel	This is the state in which is waited … • either for the control connection to be opened, • or for verification that the tunnel is already open. Once an indication is received that the tunnel has/was opened, session control messages may be exchanged. The first of these is the Incoming Call Request.
waitReply	This is the state where an Incoming or Outgoing Call Reply message is awaited. If an Incoming or Outgoing Call Reply message is received, an incoming or Outgoing Call Connected message is sent and the session moves to the established state.
waitConnect	This is the state where an Incoming or Outgoing Call Connected message is awaited. If an Incoming or Outgoing Call Connected message is received, the call was successful and the session moves to the established state.
established	Data is exchanged over the tunnel. The session is terminated when receiving or sending a Call Disconnect Notify message. The session then returns to the idle state.

L2TP status - delivery states

The states associated with the packet delivery are:

Value	Description
operating	The Telindus 1431 SHDSL CPE has sent a packet, but has not received an acknowledgement on this packet yet.
idle	All transmitted packets have been acknowledged.

L2TP status - authentication states

The states associated with the LNS or LAC authentication are:

Value	Description
noAuthentication	Authentication is not enabled. This is also the start-up state for the authentication process.
authenSuccessful	Authentication was successful. The Telindus 1431 SHDSL CPE remains in this state during data transfer.
authenFailure	Authentication failed. This is a transient state since the Telindus 1431 SHDSL CPE starts the handshake again after a failing authentication.

15.9.4 OSPF status attributes

This section discusses the status attributes concerned with OSPF. First it describes the general OSPF status attributes. Then it explains the OSPF area status attributes.

The following gives an overview of this section:

- General OSPF status attributes on page 649
- Area status attributes on page 654

General OSPF status attributes

This section describes the following status attributes:

- telindus1431Router/router/ospf/type on page 650
- telindus1431Router/router/ospf/routes on page 651
- telindus1431Router/router/ospf/externalRoutes on page 652
- telindus1431Router/router/ospf/asExtLsas on page 653

telindus1431Router/router/ospf/type

This attribute indicates the kind of router link being described.

The type structure contains the following elements

Element	Description
areaBorder	This element indicates whether the router is an Area Border Router.
asbr	This element indicates whether the router is an Autonomous System Border Router. Refer to 10.6.1 - Introducing OSPF on page 212 for more information.
virtualLink	This element indicates whether a virtual link is present on the router.
wildCardMulticast	This element indicates whether multicast extensions are supported by the router. Note that wildcard multicast is not yet supported by the Telindus 1431 SHDSL CPE.
nssaTranslator	This element indicates whether the router is an NSSA border router translator.

telindus1431Router/router/ospf/routes

This attribute displays all detected routes in the OSPF network. All detected routes are transferred to the routing table of this router as type OSPF.

The routes table contains the following elements:

Element	Description
network	This element displays the IP address of the sub network.
mask	This element displays the network mask.
type	This element displays the type of the network. Possible values are: • direct. This value indicates a direct route. This is a route to a host connected directly to the router. • intra. This value indicates an intra-area route. This is a route with destinations belonging to one of the router's attached areas. • inter. This value indicates an inter-area route.This is a route with destinations in other OSPF areas. • extType1. This value indicates an external route of type 1. • extType2. This value indicates an external route of type 2. • reject. This value indicates a rejected route. • static. This value indicates a static route. • none. This value indicates a non-existing route.
cost	This element displays the cost of the route. There are two exceptions, when another value is displayed. These are: • unknown. This value indicates that the cost of the route is unknown. • infinite. This value indicates that the route is not available.
gateway	This element displays the IP address of the next interface on the path to the destination network.
outgoingIp	This element displays the IP address of the outgoing router interface.
interface	This element displays the administrative name of the interface.

telindus1431Router/router/ospf/externalRoutes

This attribute displays all external routes which are injected into the OSPF network by this router.

The externalRoutes table contains following elements:

Element	Description
network	This element displays the IP address of the sub network.
mask	This element displays the network mask.
gateway	This element displays the IP address of the next interface on the path to the destination network.
interface	This element displays the administrative name of the interface.
costType	This element displays the type of cost of the external route. Possible values are: • type1. The type of cost of the external route is type 1. • type2. The type of cost of the external route is type 2. Also refer to telindus1431Router/router/ospf/importFilter on page 507.
cost	This element displays the cost of the route. There are two exceptions, when another value is displayed. These are: • unknown. This value indicates that the cost of the route is unknown. • infinite. This value indicates that the route is not available.
tag	This element displays the 32-bit field attached to each external route. This is not used by the OSPF protocol itself. It is used to communicate information between AS boundary routers.
advertise	This element displays whether the router advertises the external route to the rest of the OPSF network. Possible values are: • yes. The router advertises the external route to the rest of the OPSF network. • no. The router does not advertise the external route to the rest of the OPSF network.
routeType	This element displays how the external route is injected into OSPF. Possible values are: • static. Static route configured by the user. • rip. This route was learned through the rip protocol.

telindus1431Router/router/ospf/asExtLsas

This attribute displays the database entries for all external routes in the OSPF network.

The asExtLsas table contains following elements:

Element	Description
linkStateId	This element displays the portion of the network that is being described by the LSA. The contents of this field depend on the type of LSA.
advRouterId	This element displays the router ID of the router that originated the LSA.
age	This element displays the time in seconds since the LSA was originated.
sequenceNr	This element displays the LS sequence number (successive instances of an LSA are given successive LS sequence numbers).
options	This element indicates if the advertising router supports optional OSPF capabilities. Routers of differing capabilities can be mixed within an OSPF routing domain. The options structure contains the following elements: • floodExternal. Entire OSPF areas can be configured as "stubs". AS-external-LSAs will not be flooded into stub areas. This capability is represented by the element floodExternal. • multicast. This element indicates whether IP multicast datagrams are forwarded. • nssa. This element indicates whether the router supports nssa area's. • externalAttributes. This element indicates the router's willingness to receive and forward external LSAs. • demandCircuit. This element indicates the router's handling of demand circuits. • opaque. This element indicates if the router can handle opaque-LSAs.
netMask	This element displays the IP address mask for the advertised destination.
costType	This element displays the type of cost of the external route. Possible values are: • type1. The type of cost of the external route is type 1. • type2. The type of cost of the external route is type 2. Also refer to telindus1431Router/router/ospf/importFilter on page 507.
cost	This element displays the cost of this route.
tag	This element displays a 32-bit field attached to each external route. This is not used by the OSPF protocol itself. It is used to communicate information between AS boundary routers.
forwardAddress	This element displays the address to which data traffic for the advertised destination is forwarded to.

Area status attributes

This section describes the following status attributes:

- telindus1431Router/router/ospf/area[ ]/interfaces on page 655
- telindus1431Router/router/ospf/area[ ]/hosts on page 657
- telindus1431Router/router/ospf/area[ ]/neighbors on page 657
- telindus1431Router/router/ospf/area[ ]/routers on page 659
- telindus1431Router/router/ospf/area[ ]/routerLsas on page 660
- telindus1431Router/router/ospf/area[ ]/networkLsas on page 662
- telindus1431Router/router/ospf/area[ ]/summLsas on page 663
- telindus1431Router/router/ospf/area[ ]/asbrLsas on page 664
- telindus1431Router/router/ospf/area[ ]/nssaLsas on page 665

telindus1431Router/router/ospf/area[ ]/interfaces

This attribute displays all interfaces available in the area. If an interface is part of more than one network, the interface belongs to the network with the most significant subnet mask.

The interfaces table contains following elements:

Element	Description
name	This element displays the name of the interface.
address	This element displays the IP address of the interface.
netMask	This element displays the subnet mask.
network	This element displays the name of the sub network the interface is part of.
type	This element displays the interface type. Possible values are: • pointToPoint: The interface is a point-to-point interface. • broadcast: The interface is a broadcast interface. • virtualLink: The interface is a virtual link interface. • loopback: The interface is a loopback interface.
cost	This element displays the cost of the link.
priority	This element displays the priority of the network.
status	This element displays the status of the router interface. Refer to telindus1431Router/router/ospf/area[ ]/interfaces/status on page 656 for more information.
dr	This element displays the IP address of the Designated Router of the sub network.
backupDr	This element displays the IP address of the Backup Designated Router.
neighbors	This element displays the amount of neighbors of the router.
adjNeighbors	This element displays the amount of adjacent neighbors of the router.
bandwidth	This element displays the bandwidth of the link.

telindus1431Router/router/ospf/area[ ]/interfaces/status

The states are listed in order of progressing functionality. For example, the inoperative state is listed first, followed by a list of intermediate states before the final, fully functional state is achieved.

Possible values are:

Value	Description
unknown	The router status is unknown.
down	This is the initial interface state. No protocol traffic at all will be sent or received.
loopback	The router's interface to the network is looped back. The interface will be unavailable for regular data traffic.
waiting	The router is trying to determine the identity of the (Backup) Designated Router for the network. To do this, the router monitors the Hello Packets it receives. The router is not allowed to elect a Backup Designated Router nor a Designated Router until it transitions out of Waiting state. This prevents unnecessary changes of (Backup) Designated Router.
pointToPoint	The interface is operational, and connects either to a physical point-to-point network or to a virtual link. Upon entering this state, the router attempts to form an adjacency with the neighbouring router. Hello Packets are sent to the neighbour every helloInterval seconds.
drOther	The interface is connected to a broadcast or NBMA network on which another router has been selected to be the Designated Router. In this state, the router itself has not been selected Backup Designated Router either. The router forms adjacencies to both the Designated Router and the Backup Designated Router (if they exist).
backupDr	The router itself is the Backup Designated Router on the attached network. It will be promoted to Designated Router when the present Designated Router fails. The router establishes adjacencies to all other routers attached to the network.
dr	In this state, this router itself is the Designated Router on the attached network. Adjacencies are established to all other routers attached to the network. The router must also originate a network-LSA for the network node.

telindus1431Router/router/ospf/area[ ]/hosts

This attribute displays all hosts in the OSPF network.

Loopback interfaces that are added to the OSPF network are referred to as *hosts*. The loop-back interface is a software interface which can be used for management purposes. This interface is always up, regardless of the state of the physical interfaces.

The hosts table contains following elements

Element	Description
intfName	This element displays the administrative name of the loop-back interface.
address	This element displays the IP address of the loop-back interface.
netMask	This element displays the subnet mask of the loop-back interface.
network	This element displays the administrative name of the network that the loop-back interface is part of.
cost	This element displays the cost of the loop-back interface link.

telindus1431Router/router/ospf/area[ ]/neighbors

This attribute displays the neighbours of the router.

Routers that share a common segment become neighbours on that segment. Neighbours are discovered via the Hello protocol. Bidirectional communication is indicated when the router sees itself listed in the neighbour's Hello Packet.

The neighbors table contains following elements:

Element	Description
interface	This element displays the administrative name of the neighbouring interface.
routerId	This element displays the unique sequence number for the router in the OSPF network.
routerPriority	This element displays the priority of the neighbouring router.
ipAddress	This element displays the IP address of the neighbouring interface.
status	This element displays the status of the neighbouring router. Refer to telindus1431Router/router/ospf/area[ ]/neighbors/status on page 658 for more information.

telindus1431Router/router/ospf/area[ ]/neighbors/status

The states are listed in order of progressing functionality. For example, the inoperative state is listed first, followed by a list of intermediate states before the final, fully functional state is achieved.

Possible values are:

Value	Description
down	This is the initial state of a neighbour conversation. It indicates that there has been no recent information received from the neighbour.
attempt	This state is only valid for neighbors attached to NBMA networks. It indicates that no recent information has been received from the neighbour, but that a more concerted effort should be made to contact the neighbour. This is done by sending the neighbour Hello packets at intervals of helloInterval
init	An Hello packet has recently been seen from the neighbour. However, bidirectional communication has not yet been established with the neighbour (i.e., the router itself did not appear in the neighbour's Hello packet). All neighbors in this state (or higher) are listed in the Hello packets sent from the associated interface.
2way	Communication between the two routers is bidirectional. This has been assured by the operation of the Hello Protocol.
exchangeStart	This is the first step in creating an adjacency between the two neighbouring routers. The goal of this step is to decide which router is the master. Neighbour conversations in this state or greater are called adjacencies.
exchange	The router is describing its entire link state database by sending Database Description packets to the neighbour. Link State Request Packets may also be sent asking for the neighbour's more recent LSAs.
loading	Link State Request packets are sent to the neighbour asking for the more recent LSAs that have been discovered (but not yet received) in the Exchange state.
fullAdjacency	The neighbouring routers are fully adjacent. These adjacencies will now appear in router-LSAs and network-LSAs.

telindus1431Router/router/ospf/area[ ]/routers

This attribute displays all routers in the current area.

The routers table contains following elements:

Element	Description
routerId	This element displays the unique sequence number for the router in this OSPF autonomous system.
gateway	This element displays the IP address of the next interface on the path to reach this router.
cost	This element displays the cost of the route.
routerType	This element indicates which type of router is detected. The routerType structure contains the following elements: • areaBorder. This element indicates that the detected router is an Area Border Router (ABR). • asbr. This element indicates that the detected router is an Autonomous System Border Router (ASBR). • virtualLink. This element indicates that the link to the detected router is a virtual link. • wildCardMulticast. This element indicates if multicast extensions are supported by the router.

telindus1431Router/router/ospf/area[ ]/routerLsas

This attribute displays the router-LSAs.

Each router in an area originates router-LSAs. The LSA describes the state and cost of the router's links (i.e., interfaces) to the area. All of the router's links to the area must be described in a single router-LSA.

The routerLsas table contains following elements:

Element	Description
linkStateId	This element displays the router's OSPF Router ID. It displays the portion of the network that is being described by the LSA. The contents of this field depend on the type of LSA.
advRouterId	This element displays the router ID of the router that originated the LSA.
age	This element displays the time in seconds since the LSA was originated.
sequenceNr	This element displays the LS sequence number (successive instances of an LSA are given successive LS sequence numbers).
options	This element indicates if the advertising router supports optional OSPF capabilities. Routers of differing capabilities can be mixed within an OSPF routing domain. The options structure contains following elements: • floodExternal. Entire OSPF areas can be configured as "stubs". AS-external-LSAs will not be flooded into stub areas. This capability is represented by the element floodExternal. • multicast. This element indicates whether IP multicast datagrams are forwarded. • nssa. This element indicates whether the router supports nssa area's. • externalAttributes. This element indicates the router's willingness to receive and forward external LSAs. • demandCircuit. This element indicates the router's handling of demand circuits. • opaque. This element indicates if the router can handle opaque-LSAs.
routerType	This element indicates the kind of router link being described. The routerType structure contains following elements: • areaBorder. This element indicates a link to an ABR. • asbr. This element indicates a link to an ASBR. • virtualLink. This element indicates a virtual link. • wildCardMulticast. This element indicates a multicast link.
linkNr	This element displays the number of router links described in this LSA.
linkId	This element identifies the object that this router link connects to. When connecting to an object that also originates an LSA (i.e., another router or a transit network) the Link ID is equal to the neighbouring LSAs Link State ID. This provides the key for looking up the neighbouring LSA in the link state database during the routing table calculation.

Element	Description
linkData	The value of this element depends on the linkType: • For connections to stub networks, linkData specifies the network's IP address mask. • For unnumbered point-to-point connections, it specifies the interface's MIB-II interface Index value. • For the other link types it specifies the router interface's IP address. This latter piece of information is needed during the routing table build process, when calculating the IP address of the next hop.
linkType	This element displays the type of the link. Possible values are: • pointToPoint. The link is a point-to-point connection. • transit. The link is a transit connection. • stub. The link is a connection within a stub area. • virtualLink. The link is a virtual link.
cost	This element displays the cost of this link.

telindus1431Router/router/ospf/area[ ]/networkLsas

This attribute displays the network-LSAs.

A network-LSA is originated for each network in the area which supports two or more routers. The network-LSA is originated by the network's Designated Router. The LSA describes all routers attached to the network, including the Designated Router itself.

The networkLsas table contains following elements:

Element	Description
linkStateId	This element displays the IP interface address of the Designated Router. It displays the portion of the network that is being described by the LSA. The contents of this field depend on the type of LSA.
AdvRouterId	This element displays the router ID of the router that originated the LSA.
age	This element displays the time in seconds since the LSA was originated.
sequenceNr	This element displays the LS sequence number (successive instances of an LSA are given successive LS sequence numbers).
options	This element indicates if the advertising router supports optional OSPF capabilities. Routers of differing capabilities can be mixed within an OSPF routing domain. The options structure contains the following elements: • floodExternal. Entire OSPF areas can be configured as "stubs". AS-external-LSAs will not be flooded into stub areas. This capability is represented by the element floodExternal. • multicast. This element indicates whether IP multicast datagrams are forwarded. • nssa. This element indicates whether the router supports nssa area‘s. • externalAttributes. This element indicates the router's willingness to receive and forward external LSAs. • demandCircuit. This element indicates the router's handling of demand circuits. • opaque. This element indicates if the router can handle opaque-LSAs.
netMask	This element displays the IP address mask for the network.
linkNr	This element displays the number of router links described in this LSA.
routerId	This element displays the router IDs of each of the routers attached to the network. Only those routers that are fully adjacent to the Designated Router are listed. The Designated Router itself is included in this list.

telindus1431Router/router/ospf/area[ ]/summLsas

This attribute displays the Summary-LSAs. Summary-LSAs are originated by area border routers and describe inter-area destinations.

The summLsas table contains following elements:

Element	Description
linkStateId	If the destination is an IP network, then the linkStateId element is an IP network number. If the destination is an AS boundary router, then the linkStateId element is the AS boundary router's OSPF Router ID. This element displays the portion of the network that is being described by the LSA. The contents of this field depend on the type of LSA.
AdvRouterId	This element displays the router ID of the router that originated the LSA.
age	This element displays the time in seconds since the LSA was originated.
sequenceNr	This element displays the LS sequence number (successive instances of an LSA are given successive LS sequence numbers).
options	This element indicates if the advertising router supports optional OSPF capabilities. Routers of differing capabilities can be mixed within an OSPF routing domain. The options structure contains the following elements: • floodExternal. Entire OSPF areas can be configured as "stubs". AS-external-LSAs will not be flooded into stub areas. This capability is represented by the element floodExternal. • multicast. This element indicates whether IP multicast datagrams are forwarded. • nssa. This element indicates whether the router supports nssa area‘s. • externalAttributes. This element indicates the router's willingness to receive and forward external LSAs. • demandCircuit. This element indicates the router's handling of demand circuits. • opaque. This element indicates if the router can handle opaque-LSAs.
netMask	This element displays the IP address mask for the destination network.
cost	This element displays the cost of this route.

telindus1431Router/router/ospf/area[ ]/asbrLsas

This attribute displays the ASBR-LSAs.

The asbrLsas table contains following elements:

Element	Description
linkStateId	This element displays the portion of the network that is being described by the LSA. The contents of this field depend on the type of LSA.
AdvRouterId	This element displays the router ID of the router that originated the LSA.
age	This element displays the time in seconds since the LSA was originated.
sequenceNr	This element displays the LS sequence number (successive instances of an LSA are given successive LS sequence numbers).
options	This element indicates if the advertising router supports optional OSPF capabilities. Routers of differing capabilities can be mixed within an OSPF routing domain. The options structure contains the following elements: • floodExternal. Entire OSPF areas can be configured as "stubs". AS-external-LSAs will not be flooded into stub areas. This capability is represented by the element floodExternal. • multicast. This element indicates whether IP multicast datagrams are forwarded. • nssa. This element indicates whether the router supports nssa area‘s. • externalAttributes. This element indicates the router's willingness to receive and forward external LSAs. • demandCircuit. This element indicates the router's handling of demand circuits. • opaque. This element indicates if the router can handle opaque-LSAs.
cost	This element displays the cost of this route.

telindus1431Router/router/ospf/area[ ]/nssaLsas

This attribute displays the NSSA-LSAs.

The nssaLsas table contains following elements:

Element	Description
linkStateId	This element displays the portion of the network that is being described by the LSA. The contents of this field depend on the type of LSA.
AdvRouterId	This element displays the router ID of the router that originated the LSA.
age	This element displays the time in seconds since the LSA was originated.
sequenceNr	This element displays the LS sequence number (successive instances of an LSA are given successive LS sequence numbers).
options	This element indicates if the advertising router supports optional OSPF capabilities. Routers of differing capabilities can be mixed within an OSPF routing domain. The options structure contains the following elements: • floodExternal. Entire OSPF areas can be configured as "stubs". AS-external-LSAs will not be flooded into stub areas. This capability is represented by the element floodExternal. • multicast. This element indicates whether IP multicast datagrams are forwarded. • nssa. This element indicates whether the router supports nssa area's. • externalAttributes. This element indicates the router's willingness to receive and forward external LSAs. • demandCircuit. This element indicates the router's handling of demand circuits. • opaque. This element indicates if the router can handle opaque-LSAs.
netMask	This element displays the IP address mask for the advertised destination.
costType	This element displays the type of cost of the external route. Possible values are: • type1. The type of cost of the external route is type 1. • type2. The type of cost of the external route is type 2.
cost	This element displays the cost of this route.
tag	This element displays a 32-bit field attached to each external route. This is not used by the OSPF protocol itself. It is used to communicate information between AS boundary routers.
forwardAddress	This element displays the address to which data traffic for the advertised destination is forwarded to.

15.9.5 VRRP status attributes

This section describes the following status attributes:

- telindus1431Router/router/vrrp[ ]/macAddress on page 667
- telindus1431Router/router/vrrp[ ]/interfaces on page 667
- telindus1431Router/router/vrrp[ ]/criticals on page 667

telindus1431Router/router/vrrp[ ]/macAddress

This attribute displays the for VRRP reserved MAC address. The first 5 bytes are fixed (00:00:5e:00:01). The last byte is the virtual router ID.

telindus1431Router/router/vrrp[ ]/interfaces

This attribute displays the status of the virtual router its interfaces.

The interfaces table contains the following elements:

Element	Description
name	This element displays the interface name.
priority	This element displays the interface priority.
status	This element displays the interface status. Possible values are: • initial: The virtual router interface is in an initial state (e.g. during the master/backup election process). • master: The virtual router interface is elected master after the master/backup election process. • backup: The virtual router interface is elected backup after the master/backup election process. • inactive: The virtual router interface is inactive (e.g. because VRRP is not active).

telindus1431Router/router/vrrp[ ]/criticals

This attribute displays the status of the virtual router interfaces that you defined as critical (refer to telindus1431Router/router/vrrp[ ]/criticals on page 534).

The criticals table contains the following elements:

Element	Description
interface	This element displays the name of the critical interface.
status	This element displays the operational status (e.g. up, down, etc.) of the critical interface.

15.10 Bridge status attributes

This section describes the following status attributes:

- telindus1431Router/bridge/bridgeGroup/ifDescr on page 669
- telindus1431Router/bridge/bridgeGroup/ifType on page 669
- telindus1431Router/bridge/bridgeGroup/ifOperStatus on page 669
- telindus1431Router/bridge/bridgeGroup/ifMtu on page 669
- telindus1431Router/bridge/bridgeGroup/ip on page 669
- telindus1431Router/bridge/bridgeGroup/macAddress on page 669
- telindus1431Router/bridge/bridgeGroup/arpCache on page 670
- telindus1431Router/bridge/bridgeGroup/bridgeCache on page 671
- telindus1431Router/bridge/bridgeGroup/bridging on page 672
- telindus1431Router/bridge/bridgeGroup/spanningTree on page 672

This section describes the following actions:

- telindus1431Router/bridge/bridgeGroup/clearArpCache on page 674
- telindus1431Router/bridge/bridgeGroup/clearBridgeCache on page 674

telindus1431Router/bridge/bridgeGroup/ifDescr

This attribute displays the interface description.

telindus1431Router/bridge/bridgeGroup/ifType

This attribute displays the interface type.

telindus1431Router/bridge/bridgeGroup/ifOperStatus

This attribute displays the current operational status of the bridge group.

telindus1431Router/bridge/bridgeGroup/ifMtu

This attribute displays the interface its Maximum Transfer Unit, i.e. the maximum number of bytes that one packet can contain on this interface.

telindus1431Router/bridge/bridgeGroup/ip

This attribute displays the IP information of the bridge.

The ip structure contains the following elements:

Element	Description
address	This is the IP address of the bridge. It is either configured or retrieved automatically.
netMask	This is the IP subnet mask of the interface. It is either configured or retrieved automatically.

telindus1431Router/bridge/bridgeGroup/macAddress

This attribute displays the MAC address of the bridge group.

telindus1431Router/bridge/bridgeGroup/arpCache

This attribute displays all the MAC address - IP address pairs from ARP requests and replies received on the LAN interface. Refer to What is the ARP cache? on page 394 for more information.

The arpCache table contains the following elements:

Element	Description
macAddress	This is the MAC address.
ipAddress	This is the associated IP address.
type	This is the ARP cache entry type. Possible values are: • dynamic. The MAC - IP address pair is retrieved from an ARP request or reply message. • static. The MAC - IP address pair is configured. There is only one static entry, i.e. the Telindus 1431 SHDSL CPE its own IP and MAC address.
timeOut	This is the time the entry will remain in the ARP cache. For the static entry, this value is 0.

telindus1431Router/bridge/bridgeGroup/bridgeCache

When a port of the bridge enters the learning state, it stores the MAC addresses of the stations situated on the network that is connected to this port. The MAC addresses are stored in a MAC address database or bridge cache. The bridgeCache attribute visualises this address database. Refer to What is the bridge cache? on page 539 for more information.

The bridgeCache table contains the following elements:

Element	Description
interface	This is the interface through which the station can be reached.
macAddress	This is the MAC address of the station situated on the network connected to the interface.
type	This displays whether the MAC address entry is static or dynamic: • dynamic. The corresponding MAC address is learned on one of the interfaces. • static. There are only two static entries: - the Telindus 1431 SHDSL CPE its own MAC address. - a MAC address used for Spanning Tree.
age	This is the elapsed time since a frame was received from the station.

Example

The following figure shows part of a bridge cache table as an example:

bridgeCache

	interface	macAddress	type	age
1	Bridge Protocol Entity	01:80:c2:00:00:00	static	00000d 00h 00m 00s
2	Bridge Protocol Entity	00:c0:89:00:fe:20	static	00000d 00h 00m 00s
3	lan	00:c0:89:00:d4:56	dynamic	00000d 00h 00m 01s
4	lan	00:c0:89:00:70:98	dynamic	00000d 00h 00m 09s
5	lan	00:c0:89:00:6b:9c	dynamic	00000d 00h 00m 16s
6	lan	00:c0:89:01:26:86	dynamic	00000d 00h 00m 05s
7	lan	00:10:b5:ec:3f:24	dynamic	00000d 00h 00m 00s
8	lan	00:a0:24:a2:97:6c	dynamic	00000d 00h 01m 25s
9	lan	00:c0:89:00:d4:53	dynamic	00000d 00h 01m 53s
10	lan	00:60:8c:95:bb:fe	dynamic	00000d 00h 00m 00s
11	lan	00:10:4b:47:38:fa	dynamic	00000d 00h 00m 15s
12	lan	00:c0:89:00:d4:c2	dynamic	00000d 00h 01m 40s

telindus1431Router/bridge/bridgeGroup/bridging

The bridging attributes or elements in the individual interface objects display the bridging information for that particular interface. This bridging attribute, however, displays the bridging information of all the (bridged) interfaces of the Telindus 1431 SHDSL CPE.

Refer to telindus1431Router/lanInterface/bridging on page 582 for a detailed description of the bridging structure. Note however that the bridge group bridging structure contains one extra element: name. This is the name of the interface as you configured it. Note that the interface can also be a DLCI, an ATM PVC, a tunnel, etc.

telindus1431Router/bridge/bridgeGroup/spanningTree

This attribute gives you the Spanning Tree status information of the bridge.

The spanningTree structure contains the following elements:

Element	Description
designatedPriority	Together, these two elements form the unique bridge identifier.
designatedMAC	They display the unique bridge identifier of the root bridge as it is indicated in the root identifier parameter of the Configuration BPDUs. These BPDUs are transmitted by the designated bridge for the LAN that is currently connected to this port. This bridge identifier is used to test the value of the root identifier parameter conveyed in received Configuration BPDUs.
rootPathCost	This is the cost of the path from this bridge to the root bridge. If this bridge is the root bridge, the rootPathCost value equals 0. Else, the rootPathCost value equals the sum of … • the path cost as it is up to the designated bridge for the LAN that is currently connected to this port (this cost is transmitted in Configuration BPDUs by the designated bridge) and • the path cost as it is configured for the root port. The rootPathCost element is used … • to test the value of the root path cost parameter conveyed in received Configuration BPDUs. • as the value of the root path cost parameter in transmitted Configuration BPDUs. The total cost of the path to the root bridge should not exceed 65500.
rootPort	This is the port identifier of the port that offers the lowest cost path to the root. If two or more ports offer equal least cost paths to the root bridge, then the root port is selected to be that with the highest designatedPriority (i.e. the lowest numerical value). If two or more ports offer equal least cost paths to the root bridge and the same designatedPriority, then the root port is selected to be that with the highest designatedPortPriority (i.e. the lowest numerical value).

Element	Description
bridgePriority	Together, these two attributes form the unique bridge identifier of this bridge.
bridgeMAC	
maxAge	This is the time-out value to be used by all bridges in the bridged LAN for discarding bridging information. The maxAge element displays the value as it is set by the root bridge. This information is conveyed by the root bridge to ensure that each bridge in the bridged LAN has a consistent value against which to test the age of stored configuration information.
helloTime	This is the interval between the generation of Configuration BPDUs by the root bridge. The helloTime element displays the value as it is set by the root bridge. This attribute is not directly used by the Spanning Tree algorithm, but it is conveyed by the root bridge to facilitate the monitoring of protocol performance by the management system.
forwardDelay	This is the time-out value to be used by all bridges in the bridged LAN for … • a bridge port applies to move from listening state to learning state or from learning state to forwarding state. • time-out (or ageing) for purging MAC addresses from the bridge cache in case a topology change is detected. The forwardDelay element displays the value as it is set by the root bridge. This information is conveyed by the root bridge to ensure that each bridge in the bridged LAN has a consistent value for the forward delay timer.
topologyChange	This is a Boolean value (0 or 1) to report … • for a bridge that is not a root bridge, whether or not the most recently accepted Configuration BPDU indicates a change in the active topology. • for the root bridge, whether or not a change in topology has been detected within the preceding topologyChangeTime period. The topologyChange element is used to … • propagate the topology change indication in transmitted Configuration BPDUs. • determine whether the short (bridgeForwardDelay) or long (bridgeTimeOut) time-out (or ageing) value is used to purge dynamic MAC addresses from the bridge cache.
topologyChange-Detection	This is a Boolean value (0 or 1) to report that a topology change has been detected by or notified to the bridge.
topologyChange-Time	This displays the time during which the root bridge transmits Configuration BPDUs indicating a topology change, after it detected this topology change. The topologyChangeTime element value is equal to the sum of the root bridge its bridgeMaxAge element value and bridgeForwardDelay element value. Refer to telindus1431Router/bridge/bridgeGroup/spanningTree on page 540 for more information on the latter two elements.

telindus1431Router/bridge/bridgeGroup/clearArpCache

Use this action to clear the ARP cache table.

telindus1431Router/bridge/bridgeGroup/clearBridgeCache

Use this action to clear the bridge cache table.

15.11 Management status attributes

This section describes the following status attributes:

- telindus1431Router/management/cms2Address on page 676
- telindus1431Router/management/timeServer on page 676
- telindus1431Router/management/alarmLog on page 676
- telindus1431Router/management/accessLog on page 677
- telindus1431Router/management/loopback/ifDescr on page 679
- telindus1431Router/management/loopback/ifType on page 679
- telindus1431Router/management/loopback/ifOperStatus on page 679
- telindus1431Router/management/loopback/ifMtu on page 679
- telindus1431Router/management/loopback/ipAddress on page 679
- telindus1431Router/management/loopback/mask on page 679

telindus1431Router/management/cms2Address

This attribute displays the absolute device address as you configured it.

telindus1431Router/management/timeServer

This attribute displays the status of the SNTP function.

The timeServer structure contains the following elements:

Element	Description
state	This is the state of the Telindus 1431 SHDSL CPE its clock. Possible values are: • notConfigured. The Telindus 1431 SHDSL CPE is not configured for SNTP. • notSynchronised. The Telindus 1431 SHDSL CPE its clock is not synchronised with the time server. • synchronised. The Telindus 1431 SHDSL CPE its clock is synchronised with the time server.
connection	This is the state of the connection with the time server. Possible values are: • notConfigured. The Telindus 1431 SHDSL CPE is not configured for SNTP. • notSynchronised. The connection with the time server is not synchronised. • synchronised. The connection with the time server is synchronised. • noContact. The connection with the time server is lost.
stratum	This is the stratum level of the time server its reference clock. Possible values are: • 0: unspecified or unavailable • 1: primary reference (e.g. radio clock) • 2 - 15: secondary reference (via SNTP)
delay	This is the total roundtrip delay of the time server with its reference clock.

telindus1431Router/management/alarmLog

This attribute displays the alarm log. It displays the 32 most recent alarms that occurred on the Telindus 1431 SHDSL CPE.

The alarmLog table contains the following elements:

Element	Description
timeStamp	This is the value of the real time clock at the moment the alarm was generated.
sysUpTime	This is the system up-time of the Telindus 1431 SHDSL CPE at the moment the alarm was generated.
totalAlarmLevel	This is the total alarm level of the Telindus 1431 SHDSL CPE.
alarmLevel	This is the alarm level of the alarm.
alarm	This is the alarm itself in the format path.alarmName on|off (e.g. telindus1431Router/lanInterface.linkDown on).

telindus1431Router/management/accessLog

This attribute displays the access log. It displays the 32 most recent login events that occurred on the Telindus 1431 SHDSL CPE.

The accessLog table contains the following elements:

Element	Description
timeStamp	This element displays the value of the real time clock at the moment the access event occurred.
sysUpTime	This element displays the system up-time of the Telindus 1431 SHDSL CPE at the moment the access event occurred.
type	This element displays the type of access event. Possible values are: • login. A successful login was detected. • loginFailure. A failed login was detected. • accessFailureOn. The number of failed logins exceeded the access failure threshold within the access failure period. Refer to telindus1431Router/management/loginControl on page 564. • accessFailureOff. After an accessFailureOn event was logged, the number of failed logins dropped below the access failure threshold within the access failure period. Refer to telindus1431Router/management/loginControl on page 564.
user	This element displays the name of the user who caused the access event. If you entered a … • password string only in the password element of the security table, then the user element displays nothing. • user/password string in the password element of the security table (of the type "username:password"), then the user element displays the username part of the user/password string. Also see telindus1431Router/security on page 388.
application	This element displays the type of application that caused the access event. Possible values are: • cms2. The access event is caused by any maintenance application. For example, TMA, TMA CLI, CLI or ATWIN (via a Telnet or terminal session), WebInterface, etc. • ftp. The access event is caused by FTP. • fileSystem. The access event is caused by any maintenance application accessing the file system. For example, FTP, TFTP, TML, etc. when downloading firmware. • snmp. The access event is caused by SNMP. Note that since SNMP is not session oriented, each successful SNMP request would result in an access event. So an SNMP walk would result in thousands of access events being logged. Therefore, in case of SNMP, only the failed requests are logged. • proxy. The access event is caused by any maintenance application accessing a CMS device through the Telindus 1431 SHDSL CPE (i.e. the Telindus 1431 SHDSL CPE acts as proxy). This since the password of the Telindus 1431 SHDSL CPE is used to control the access to the CMS devices.

Element	Description
accessRights	This element displays the access rights that are associated with the access event.

Note that some applications may cause more than one access event. For example, suppose you access the Telindus 1431 SHDSL CPE with FTP and download a file to the file system. In that case two events are logged in the accessLog table:

1. One event logging the access of the FTP application to the Telindus 1431 SHDSL CPE.
2. One event logging the access of the FTP application to the file system when downloading the file.

19	Jul 13 15:14:14	00000d 00h 03m 38s	login	test	ftp	01111
20	Jul 13 15:14:26	00000d 00h 03m 51s	login	test	fileSystem	01111

telindus1431Router/management/loopback/ifDescr

This attribute displays the interface description.

telindus1431Router/management/loopback/ifType

This attribute displays the interface type.

telindus1431Router/management/loopback/ifOperStatus

This attribute displays the current operational status of the loopback interface.

The loopback interface is always up.

telindus1431Router/management/loopback/ifMtu

This attribute displays the interface its Maximum Transfer Unit, i.e. the maximum number of bytes that one packet can contain on this interface.

telindus1431Router/management/loopback/ipAddress

This attribute displays the IP address of the loopback interface as you configured it.

telindus1431Router/management/loopback/mask

This attribute displays the subnet mask of the loopback interface as you configured it.

15.12 File system status attributes

This section describes the following status attributes:

- telindus1431Router/fileSystem/fileList on page 681
- telindus1431Router/fileSystem/freeSpace on page 681
- telindus1431Router/fileSystem/status on page 681
- telindus1431Router/fileSystem/corruptBlocks on page 681

This section describes the following actions:

- telindus1431Router/fileSystem/Delete File on page 682
- telindus1431Router/fileSystem/Rename File on page 682

telindus1431Router/fileSystem/fileList

Part of the flash memory of the Telindus 1431 SHDSL CPE is organised as a file system and a number of files are stored in it. The fileList attribute shows all the files that are present on the file system. Usually, the following files are present:

- The configuration file of the Telindus 1431 SHDSL CPE (file config1.db).
- Up to two application software files of the Telindus 1431 SHDSL CPE (files CONTROL1 and CONTROL 2).

The fileList table contains the following elements:

Element	Description
name	This is the filename. Maximum length of the filename is 24 characters. All characters are allowed (including spaces). The filename is case sensitive.
length	This is the length of the file in bytes.

telindus1431Router/fileSystem/freeSpace

This attribute displays the number of free bytes on the file system.

telindus1431Router/fileSystem/status

This attribute displays the status of the file system. Possible values are:

Value	Description
ready	Normal situation.
formatting	The file system is being formatted. This can be triggered when the file system is found to be corrupt at boot.
corrupt	The file system is in a state were no guarantee can be given about the correct operation of the file system. The file system will be formatted at the following boot.
corruptBlocks	A certain block can not be erased.

telindus1431Router/fileSystem/corruptBlocks

The file system of the Telindus 1431 SHDSL CPE consists of several blocks. When a block can not be erased, the corruptBlocks count is incremented. This block can no longer be used to store data.

telindus1431Router/fileSystem/Delete File

Use this action to remove obsolete files from the file system. You have to enter the filename you want to delete as argument value.

Filenames are case sensitive!

telindus1431Router/fileSystem/Rename File

Use this action to rename a file on the file system. You have to enter the old and new filename in a structure.

Filenames are case sensitive!

15.13 Operating system status attributes

This section describes the following status attributes:

- telindus1431Router/operatingSystem/taskInfo on page 684

telindus1431Router/operatingSystem/taskInfo

This attribute displays status information about the operating system.

The taskInfo table contains the following elements:

Element	Description
taskName	This is the name of the task.
taskStatus	This is the current status of the task. Possible values are: • awake. This task is actually running. • asleep. This task is waiting on an event. • inactive. This task slot is not active, i.e. no task has been assigned to this slot.
load30s	This is the load on the processor, in percent, during the last 30 seconds.
load5m	This is the load on the processor, in percent, during the last 5 minutes.
runningInMedium	Each task can be running with a low, medium or high priority. This element gives the percentage of time this task has been running with medium priority during the last 30 seconds.
runningInHigh	Each task can be running with a low, medium or high priority. This element gives the percentage of time this task has been running with high priority during the last 30 seconds. The percentage of time this task has been running with low priority can be calculated using the following formula: running in low priority = 100% - runningInMedium - runningInHigh
programCounter	This is the current value of the program counter. The program counter is the memory address for the current instruction of this task.

16 Performance attributes

This chapter discusses the performance attributes of the Telindus 1431 SHDSL CPE. The following gives an overview of this chapter:

- 16.1 - Performance attributes overview on page 686
- 16.2 - General performance attributes on page 692
- 16.3 - LAN interface performance attributes on page 694
- 16.4 - WAN interface performance attributes on page 699
- 16.5 - Encapsulation performance attributes on page 700
- 16.6 - SHDSL line performance attributes on page 712
- 16.7 - End performance attributes on page 716
- 16.8 - Modular user interface performance attributes on page 717
- 16.9 - Router performance attributes on page 723
- 16.10 - Bridge performance attributes on page 740
- 16.11 - Management performance attributes on page 746
- 16.12 - Operating system performance attributes on page 749

16.1 Performance attributes overview

> telindus1431Router
Action: resetAllCounters

>> lanInterface
ifInOctets
ifInUcastPkts
ifInNUcastPkts
ifInDiscards
ifInErrors
ifInUnknownProtos
ifOutOctets
ifOutUcastPkts
ifOutNUcastPkts
ifOutDiscards
ifOutErrors
ifOutQLen
h2Performance
h24Performance
ifOutPQLen
ifDropLevelExceeded
vlan
Action: resetCounters

>> wanInterface
ifInOctets
ifInUcastPkts
ifInNUcastPkts
ifInDiscards
ifInErrors
ifInUnknownProtos
ifOutOctets
ifOutUcastPkts
ifOutNUcastPkts
ifOutDiscards
ifOutErrors
ifOutQLen
ifOutPQLen
ifDropLevelExceeded
h2Performance
h24Performance
Action: resetCounters

>>> atm
pvcTable
unknownCells
vp
Action: resetCounters

```
>>> line
    h2Line
    h24Line
    d7Line
    line
    Action: retrain
    Action: resetCounters

>>>> linePair[ ]
        h2LineParameters
        h2Performance
        h24LineParameters
        h24Performance
        d7LineParameters
        d7Performance
        lineParameters
        performance
        Action: resetCounters

>>> end

>>>> linePair[ ]
        h2LineParameters
        h2Performance
        h24LineParameters
        h24Performance
        d7LineParameters
        d7Performance
        lineParameters
        performance
        Action: resetCounters

>> g703
    h2G703Performance
    h24G703Performance
    d7G703Performance
    g703Performance
    h2G826Performance
    h24G826Performance
    d7G826Performance
    g826Performance
    Action: resetCounters
```

>>> channel[g703_1]
- ifInOctets
- ifInUcastPkts
- ifInNUcastPkts
- ifInDiscards
- ifInErrors
- ifInUnknownProtos
- ifOutOctets
- ifOutUcastPkts
- ifOutNUcastPkts
- ifOutDiscards
- ifOutErrors
- ifOutQLen
- ifOutPQLen
- ifDropLevelExceeded
- h2Performance
- h24Performance
- Action: resetCounters

>>>> frameRelay
- dlciTable
- lmi
- cllmInFrames
- Action: resetCounters

>>>> ces
- insDumCells
- acceptCells
- discardCells
- underruns
- overruns
- Action: resetCounters

>>> transpChannel[ ]

<Contains the same attributes as the channel[g703_1] object. It also contains the ces sub-object. It does not contain the frameRelay sub-object.>

>> <serialIf>
- ifInOctets
- ifInUcastPkts
- ifInNUcastPkts
- ifInDiscards
- ifInErrors
- ifInUnknownProtos
- ifOutOctets
- ifOutUcastPkts
- ifOutNUcastPkts
- ifOutDiscards
- ifOutErrors
- ifOutQLen
- h2Performance
- h24Performance
- Action: resetCounters

>>> frameRelay
- dlciTable
- lmi
- cllmInFrames
- Action: resetCounters

>>> ces
- insDumCells
- acceptCells
- discardCells
- underruns
- overruns
- Action: resetCounters

>> router
- routingTable
- radiusAuth
- radiusAcct
- pingResults
- tracertResults
- Action: startPing
- Action: stopPing
- Action: startTracert
- Action: stopTracert
- Action: clearTracert
- Action: resetCounters

>>> defaultNat
- socketsFree
- allocFails
- discards
- addressesAvailable
- tcpSocketsUsed
- udpSocketsUsed
- icmpSocketsUsed
- tcpAllocs
- udpAllocs
- icmpAllocs
- Action: reset
- Action: resetCounters

>>> tunnels
- l2tpTunnels
- ipsecL2tpTunnels
- Action: resetCounters

>>> manualSA[ ]
- inPackets
- outPackets
- espAuthenticationFailure
- espDecryptionFailure
- espSequenceNrReplay
- espDroppedFrames
- Action: resetCounters

>>> trafficPolicy[ ]
- discards
- trafficShaping
- Action: resetCounters

>> bridge

>>> bridgeGroup
- bridgeCache
- bridgeDiscards
- bridgeFloods
- multiVlans
- Action: resetCounters

>>> accessList[ ]
- bridgeAccessList
- Action: resetCounters

>> management

cms2SessionCount
tftpSessionCount
cliSessionCount
tcpSessionCount
ipStackEvents
Action: resetCounters

>> operatingSystem

currUsedProcPower
usedProcPower
freeDataBuffers
totalDataBuffers
largestFreeBlockSize
freeBlockCount
freeMemory
totalMemory
taskInfo
Action: resetCounters

16.2 General performance attributes

There are no general performance attributes. However, there is one general performance action:

- telindus1431Router/resetAllCounters on page 693

telindus1431Router/resetAllCounters

Use this action to reset *all* counters in *all* objects in the containment tree of the Telindus 1431 SHDSL CPE.

You can also reset the counters per object. To do so, use the resetCounters action located in the corresponding object.

16.3 LAN interface performance attributes

This section describes the following performance attributes:

- telindus1431Router/lanInterface/ifInOctets on page 695
- telindus1431Router/lanInterface/ifInUcastPkts on page 695
- telindus1431Router/lanInterface/ifInNUcastPkts on page 695
- telindus1431Router/lanInterface/ifInDiscards on page 695
- telindus1431Router/lanInterface/ifInErrors on page 695
- telindus1431Router/lanInterface/ifInUnknownProtos on page 695
- telindus1431Router/lanInterface/ifOutOctets on page 696
- telindus1431Router/lanInterface/ifOutUcastPkts on page 696
- telindus1431Router/lanInterface/ifOutNUcastPkts on page 696
- telindus1431Router/lanInterface/ifOutDiscards on page 696
- telindus1431Router/lanInterface/ifOutErrors on page 696
- telindus1431Router/lanInterface/ifOutQLen on page 696
- telindus1431Router/lanInterface/h2Performance on page 697
- telindus1431Router/lanInterface/h24Performance on page 697
- telindus1431Router/lanInterface/ifOutPQLen on page 697
- telindus1431Router/lanInterface/ifDropLevelExceeded on page 697
- telindus1431Router/lanInterface/vlan on page 698

telindus1431Router/lanInterface/ifInOctets

This attribute displays the number of octets (bytes) received on this interface.

telindus1431Router/lanInterface/ifInUcastPkts

This attribute displays the number of unicast packets received on this interface and delivered to a higher-layer protocol. Unicast packets are all non-multicast and non-broadcast packets.

telindus1431Router/lanInterface/ifInNUcastPkts

This attribute displays the number of non-unicast packets received on this interface and delivered to a higher-layer protocol. Non-unicast packets are all the multicast and broadcast packets.

telindus1431Router/lanInterface/ifInDiscards

This attribute displays the number of incoming packets that were discarded, to prevent their deliverance to a higher-layer protocol. This even though no errors were detected in these packets.

telindus1431Router/lanInterface/ifInErrors

This attribute displays the number of incoming packets that could not be delivered to a higher-layer protocol because they contained errors.

telindus1431Router/lanInterface/ifInUnknownProtos

This attribute displays the number of incoming packets that were discarded because they contained an unknown or unsupported protocol.

telindus1431Router/lanInterface/ifOutOctets

This attribute displays the total number of octets (bytes) transmitted by the interface, including framing characters.

telindus1431Router/lanInterface/ifOutUcastPkts

This attribute displays the total number of packets that higher-level protocols requested to be transmitted to a unicast address, including those that were discarded or not sent.

telindus1431Router/lanInterface/ifOutNUcastPkts

This attribute displays the number of non-unicast packets that higher-level protocols requested to be transmitted to a non-unicast (i.e. a broadcast or multicast) address, including those that were discarded or not sent.

telindus1431Router/lanInterface/ifOutDiscards

This attribute displays the number of outgoing packets that were discarded, to prevent they are transmitted by the interface. This could be due to, for instance, the presence of an access list.

telindus1431Router/lanInterface/ifOutErrors

This attribute displays the number of outgoing packets that could not be transmitted by the interface because they contained errors. On the LAN interface ifOutErrors are also generated in case of extensive collisions.

telindus1431Router/lanInterface/ifOutQLen

This attribute displays the length, expressed in packets, of the output packet queue on the interface.

telindus1431Router/lanInterface/h2Performance

This attribute displays the 2 hours performance summary of the LAN interface.

The h2Performance table contains the following elements:

Element	For the corresponding period, this element displays …
sysUpTime	the elapsed time since the last cold boot.
ifUpTime	the time during which the interface was up.
ifStatusChanges	the number of times the ifOperStatus value of the interface changed (from up to down or vice versa).
ifInOctets	the number of octets (bytes) received on this interface.
ifInPackets	the number of packets received on this interface.
ifInErrors	the number of packets received on this interface that could not be delivered to a higher-layer protocol because they contained errors.
ifOutOctets	the number of octets (bytes) transmitted by the interface, including framing characters.
ifOutPackets	the number of packets transmitted by the interface.
ifOutDiscards	the number of outgoing packets that were discarded, to prevent they were transmitted by the interface. This could be due to, for instance, the presence of an access list.
ifOutErrors	the number of packets that could not be transmitted by the interface because they contained errors.

telindus1431Router/lanInterface/h24Performance

This attribute displays the 24 hours performance summary of the LAN interface. The h24Performance table contains the same elements as the telindus1431Router/lanInterface/h2Performance table.

telindus1431Router/lanInterface/ifOutPQLen

In case an overload condition occurs and priority queuing is activated, then this attribute displays how many packets the different queues contain.

Refer to 10.8.1 - Introducing traffic and priority policy on page 239 for more information on the priority queues.

telindus1431Router/lanInterface/ifDropLevelExceeded

This attribute displays how many times the drop levels of the user configurable queues have been exceeded (and hence packets have been dropped).

Refer to telindus1431Router/router/trafficPolicy[ ]/dropLevels on page 524 for more information on the drop levels.

telindus1431Router/lanInterface/vlan

This attribute displays the SNMP MIB2 performance parameters of the VLANs that are present on the LAN interface.

The vlan table contains the following elements:

Element	Description
name	This element displays the name of the VLAN as you configured it.
vlan	This element displays the VLAN ID.
mibCounters	This element displays the SNMP MIB2 performance parameters of the VLAN. Refer to 16.3 - LAN interface performance attributes on page 694 for an explanation of the individual SNMP MIB2 performance parameters.

16.4 WAN interface performance attributes

All performance attributes of the WAN interface are the same as on the LAN interface. Therefore, they are not explained here again. Refer to 16.3 - LAN interface performance attributes on page 694 for a complete description of these attributes.

16.5 Encapsulation performance attributes

This section discusses the performance attributes of the encapsulation protocols that can be used on the Telindus 1431 SHDSL CPE.

The following gives an overview of this section:

- 16.5.1 - ATM performance attributes on page 701
- 16.5.2 - Frame Relay performance attributes on page 706
- 16.5.3 - CES performance attributes on page 710

16.5.1 ATM performance attributes

This section describes the following performance attributes:

- telindus1431Router/wanInterface/atm/pvcTable on page 702
- telindus1431Router/wanInterface/atm/unknownCells on page 705
- telindus1431Router/wanInterface/atm/vp on page 705

telindus1431Router/wanInterface/atm/pvcTable

This attribute lists the complete performance information of all known PVCs.

The pvcTable table contains the following elements:

Element	Description
name	This is the name of the PVC as you configured it.
mibCounters	This displays the SNMP MIB2 parameters of the PVC. These are the same as the SNMP MIB2 parameters on the LAN interface. Refer to 16.3 - LAN interface performance attributes on page 694. If CES is used, then the mibCounters attribute is not incremented (this because in case of CES cells are counted, not packets). Refer to the <modularIf>/ces object to see the CES performance attributes (16.5.3 - CES performance attributes on page 710).
priorityQLengths	In case an overload condition occurs and priority queuing is activated, then this elements displays how many packets the different queues contain. Refer to 10.8.1 - Introducing traffic and priority policy on page 239 for more information on the priority queues.
atm	This displays the specific ATM related performance information of the PVC. Refer to telindus1431Router/wanInterface/atm/pvcTable/atm on page 703 for a detailed description of the atm structure

telindus1431Router/wanInterface/atm/pvcTable/atm

The atm structure in the pvcTable displays the specific ATM related performance information of the PVC.

The atm structure contains the following elements:

Element	Description
vpi	This displays the Virtual Path Identifier (VPI).
vci	This displays the Virtual Channel Identifier (VCI). The VPI in conjunction with the VCI identifies the next destination of a cell as it passes through a series of ATM switches on the way to its destination.
oamF5	This displays the performance information of the OAM F5 loopback cells. The oamF5 structure contains the following elements: • rxLoopback. This displays the number of received loopback cells. • txLoopback. This displays the number of transmitted loopback cells. • rxCC. This displays the number of received continuity check cells. • txCC. This displays the number of transmitted continuity check cells. • rxAD. This displays the number of received and accepted continuity check activator/deactivator cells. • rxADdrop. This displays the number of received continuity check activator/deactivator cells that were dropped (e.g. because the correlation tag was wrong). • txAD. This displays the number of transmitted continuity check activator/deactivator cells. • rxSegAis. This displays the number of received segment Alarm Indication Signals. • txSegAis. This displays the number of transmitted segment Alarm Indication Signals. • rxSegRdi. This displays the number of received segment Remote Defect Indications. • txSegRdi. This displays the number of transmitted segment Remote Defect Indications. • rxEteAis. This displays the number of received end-to-end Alarm Indication Signals. • txEteAis. This displays the number of transmitted end-to-end Alarm Indication Signals. • rxEteRdi. This displays the number of received end-to-end Remote Defect Indications. • txEteRdi. This displays the number of transmitted end-to-end Remote Defect Indications.

Element	Description
	What is OAM segment/end-to-end VP/VC AIS and RDI? OAM VP/VC AIS (Alarm Indication Signal) and RDI (Remote Defect Indication) are cells that are used for identifying and reporting VP/VC defects on a segment/end-to-end level. When a physical link or interface failure occurs, intermediate nodes insert AIS cells into all the downstream VP/VCs affected by the failure. Upon receiving an AIS cell on a VP/VC, the router marks the logical interface down and sends an RDI cell on the same VP/VC to let the remote end know the error status. When an RDI cell is received on a VP/VC, the router sets the logical interface status to down.

telindus1431Router/wanInterface/atm/unknownCells

This attribute displays the number of received cells that are not in-band for a certain PVC.

Example

Suppose router A sends OAM F4 loopback cells on VPI 5. On router B no VPI 5 is configured or no OAM F4 loopback cells are configured for VPI 5. In that case, the unknownCells value on router B will increase.

telindus1431Router/wanInterface/atm/vp

Whereas the atm structure in the pvcTable displays the OAM F5 loopback cell performance information for each Virtual Channel, the vp table displays the OAM F4 loopback cell performance information of a complete Virtual Path.

The vp table contains the following elements:

Element	Description
vpi	This is the Virtual Path Identifier (VPI).
oamF4	This displays the performance information of the OAM F4 loopback cells. The oamF4 structure contains the following elements: • rxLoopback. This displays the number of received OAM F4 loopback cells. • txLoopback. This displays the number of transmitted OAM F4 loopback cells.

16.5.2 Frame Relay performance attributes

This section describes the following performance attributes:

- telindus1431Router/<modularIf>/frameRelay/dlciTable on page 707
- telindus1431Router/<modularIf>/frameRelay/lmi on page 709
- telindus1431Router/<modularIf>/frameRelay/cllmInFrames on page 709

telindus1431Router/<modularIf>/frameRelay/dlciTable

This attribute lists the complete performance information of all known DLCIs.

The dlciTable table contains the following elements:

Element	Description
name	This is the name of the DLCI as you configured it.
mibCounters	This displays the SNMP MIB2 parameters of the DLCI. These are the same as the SNMP MIB2 parameters on the LAN interface. Refer to 16.3 - LAN interface performance attributes on page 694.
frameRelay	This displays the specific Frame Relay related performance information of the DLCI. Refer to telindus1431Router/<modularIf>/frameRelay/dlciTable/frameRelay on page 708 for a detailed description of the frameRelay structure.

telindus1431Router/<modularIf>/frameRelay/dlciTable/frameRelay

The frameRelay structure in the dlciTable displays the specific Frame Relay related performance information of the DLCI.

The frameRelay structure contains the following elements:

Element	Description
dlci	This is the DLCI identification number.
inFecn	This is the number of frames received from the network indicating forward congestion and this since the virtual circuit was created.
inBecn	This is the number of frames received from the network indicating backward congestion and this since the virtual circuit was created.
inDe	This is the number of frames received with the Discard Eligibility bit set.
inOctets	This is the number of octets received over this virtual circuit since it was created.
inFrames	This is the number of frames received over this virtual circuit since it was created.
outFecn	This is the number of frames sent to the network indicating forward congestion and this since the virtual circuit was created.
outBecn	This is the number of frames sent to the network indicating backward congestion and this since the virtual circuit was created.
outDe	This is the number of frames sent to the network with the Discard Eligibility bit set.
outOctets	This is the number of octets sent over this virtual circuit since it was created.
outFrames	This is the number of frames sent over this virtual circuit since it was created.

telindus1431Router/<modularIf>/frameRelay/lmi

This attribute gives a complete LMI performance overview.

The lmi structure contains the following elements:

Element	Description
inStatusEnquiry	This is the number of Status Enquiries received from the network.
inStatus	This is the number of Status Reports received from the network.
inStatusUpdate	This is the number of unsolicited Status Updates received from the network.
outStatusEnquiry	This is the number of Status Enquiries sent to the network.
outStatus	This is the number of Status Reports sent to the network.
outStatusUpdate	This is the number of unsolicited Status Updates sent to the network.
netPollNotRcvd	This is the number of times the expectedPollInterval expired without an incoming status enquiry.
userNoResponse-Rcvd	This is the number of times a response was not received.
userBadResponses-Rcvd	This is the number of times an invalid response was received.

telindus1431Router/<modularIf>/frameRelay/cllmInFrames

This attribute displays the total number of received CLLM (Consolidated Link Layer Management) frames.

16.5.3 CES performance attributes

This section describes the following performance attributes:

- telindus1431Router/<modularIf>/ces/insDumCells on page 711
- telindus1431Router/<modularIf>/ces/acceptCells on page 711
- telindus1431Router/<modularIf>/ces/discardCells on page 711
- telindus1431Router/<modularIf>/ces/underruns on page 711
- telindus1431Router/<modularIf>/ces/overruns on page 711

telindus1431Router/<modularIf>/ces/insDumCells

This attribute displays the number of inserted dummy cells. Dummy cells are inserted in case the ATM cell buffer underruns. A buffer underrun occurs when cells are lost or discarded. So the number of inserted dummy cells = number of lost cells + number of discarded cells.

For more information on the ATM cell buffer refer to …

- telindus1431Router/<modularIf>/ces/maxCellVariation on page 435
- telindus1431Router/<modularIf>/ces/outstandingCells on page 606

telindus1431Router/<modularIf>/ces/acceptCells

This attribute displays the number of accepted cells.

telindus1431Router/<modularIf>/ces/discardCells

This attribute displays the number of discarded cells.

telindus1431Router/<modularIf>/ces/underruns

This attribute displays the number of times an ATM cell buffer underrun occurred.

For more information on the ATM cell buffer refer to …

- 9.3.1 - Introducing CES encapsulation on page 165
- telindus1431Router/<modularIf>/ces/maxCellVariation on page 435
- telindus1431Router/<modularIf>/ces/outstandingCells on page 606

telindus1431Router/<modularIf>/ces/overruns

This attribute displays the number of times an ATM cell buffer overrun occurred.

For more information on the ATM cell buffer refer to …

- 9.3.1 - Introducing CES encapsulation on page 165
- telindus1431Router/<modularIf>/ces/maxCellVariation on page 435
- telindus1431Router/<modularIf>/ces/outstandingCells on page 606

16.6 SHDSL line performance attributes

This section describes the following line performance attributes:

- telindus1431Router/wanInterface/line/h2Line on page 713
- telindus1431Router/wanInterface/line/h24Line on page 713
- telindus1431Router/wanInterface/line/d7Line on page 713
- telindus1431Router/wanInterface/line/line on page 713

This section describes the following line pair performance attributes:

- telindus1431Router/wanInterface/line/linePair[ ]/h2LineParameters on page 714
- telindus1431Router/wanInterface/line/linePair[ ]/h24LineParameters on page 714
- telindus1431Router/wanInterface/line/linePair[ ]/d7LineParameters on page 714
- telindus1431Router/wanInterface/line/linePair[ ]/lineParameters on page 714
- telindus1431Router/wanInterface/line/linePair[ ]/h2Performance on page 715
- telindus1431Router/wanInterface/line/linePair[ ]/h24Performance on page 715
- telindus1431Router/wanInterface/line/linePair[ ]/d7Performance on page 715
- telindus1431Router/wanInterface/line/linePair[ ]/performance on page 715

This section describes the following actions:

- telindus1431Router/wanInterface/line/retrain on page 713

telindus1431Router/wanInterface/line/h2Line

This attribute displays the 2 hours performance information summary of the line.

The h2Line table contains the following elements:

Element	For the corresponding period, this element displays …
sysUpTime	the elapsed time since the last cold boot.
linkDownCount	the number of times the link went down.
linkDownTime	the total amount of time the link was down.

telindus1431Router/wanInterface/line/h24Line

This attribute displays the 24 hours performance information summary of the line. The h24Line table contains the same elements as the telindus1431Router/wanInterface/line/h2Line table.

telindus1431Router/wanInterface/line/d7Line

This attribute displays the 7 days performance information summary of the line. The d7Line table contains the same elements as the telindus1431Router/wanInterface/line/h2Line table.

telindus1431Router/wanInterface/line/line

This attribute displays the performance information summary of the line since the last cold boot. Except for the sysUpTime, the line structure contains the same elements as the telindus1431Router/wanInterface/line/h2Line table.

telindus1431Router/wanInterface/line/retrain

Use this action to force a retrain on the line.

telindus1431Router/wanInterface/line/linePair[ ]/h2LineParameters

This attribute displays the 2 hours line parameter summary.

The h2LineParameters table contains the following elements:

Element	For the corresponding period, this element displays …
sysUpTime	the elapsed time since the last cold boot.
lineAttenuationMin	the minimum line attenuation that was measured.
lineAttenuationAvrg	the average line attenuation that was calculated
lineAttenuationMax	the maximum line attenuation that was measured.
signalNoiseMin	the minimum signal to noise ratio that was measured.
signalNoiseAvrg	the average signal to noise ratio that was calculated.
signalNoiseMax	the maximum signal to noise ratio that was measured.

telindus1431Router/wanInterface/line/linePair[ ]/h24LineParameters

This attribute displays the 24 hours line parameter summary. The h24LineParameters table contains the same elements as the telindus1431Router/wanInterface/line/linePair[ ]/h2LineParameters table.

telindus1431Router/wanInterface/line/linePair[ ]/d7LineParameters

This attribute displays the 7 days line parameter summary. The d7LineParameters table contains the same elements as the telindus1431Router/wanInterface/line/linePair[ ]/h2LineParameters table.

telindus1431Router/wanInterface/line/linePair[ ]/lineParameters

This attribute displays the line parameter summary since the last cold boot. Except for the sysUpTime, the lineParameters table contains the same elements as the telindus1431Router/wanInterface/line/linePair[ ]/h2LineParameters table.

telindus1431Router/wanInterface/line/linePair[ ]/h2Performance

This attribute displays the 2 hours performance summary of the line.

The h2Performance table contains the following elements:

Element	For the corresponding period, this element displays …
sysUpTime	the elapsed time since the last cold boot.
codeViolations	the number of line errors that was counted.
errSec	the number of erroneous seconds that was counted.
sevErrSec	the number of severely erroneous seconds that was counted.
unavailSec	the number of unavailable seconds that was counted.
loswSec	the number of lost synchronisation words seconds that was counted.
moniSec	the number of monitored seconds.

- Errors are counted based on the SHDSL frame CRC.
- For the correct and unambiguous definition of code violations, errored and severely errored seconds, unavailability and lost synchronisation words seconds, refer to the recommendation G.826.

telindus1431Router/wanInterface/line/linePair[ ]/h24Performance

This attribute displays the 24 hours performance summary of the line. The h24Performance table contains the same elements as the telindus1431Router/wanInterface/line/linePair[ ]/h2Performance table.

telindus1431Router/wanInterface/line/linePair[ ]/d7Performance

This attribute displays the 7 days performance summary of the line. The d7Performance table contains the same elements as the telindus1431Router/wanInterface/line/linePair[ ]/h2Performance table.

telindus1431Router/wanInterface/line/linePair[ ]/performance

This attribute displays the performance summary of the line since the last cold boot. Except for the sysUpTime, the performance table contains the same elements as the telindus1431Router/wanInterface/line/linePair[ ]/h2Performance table.

16.7 End performance attributes

Exactly which information is retrieved from the remote SHDSL device(s) through the EOC channel depends on the setting of the eocHandling attribute. Refer to 5.4.4 - Which standard EOC information is retrieved? on page 76 for an overview.

The performance information of the line pairs and of the end device is only retrieved in case the eocHandling attribute is set to info or alarmConfiguration. Other than that, the end/linePair[ ] objects contain the same performance attributes as the line/linePair[ ] object. Refer to 16.6 - SHDSL line performance attributes on page 712 for more information on these attributes.

Note that the sysUpTime in the performance attributes of the end/linePair[ ] objects is not the elapsed time since the last cold boot, but the elapsed time since the creation of the end object.

16.8 Modular user interface performance attributes

This section discusses the performance attributes of the modular user interfaces.

First it describes the performance attributes that are common for both the G703 and serial interfaces. Then it describes the performance attributes that specifically apply on the G703 interface.

The following gives an overview of this section:

- 16.8.1 - Common performance attributes on page 718
- 16.8.2 - G703 interface performance attributes on page 719

The performance attributes of the encapsulation protocols that can be used on the modular user interfaces are explained in 16.5 - Encapsulation performance attributes on page 700.

16.8.1 Common performance attributes

Depending on which type of modular user interface is used, the name of the modular user interface object (labelled <modularIf> in the following text) can be g703, g703/channel[g703_1], rs530, v35, v36 or x21.

The performance attributes in the <modularIf> object are the same as on the LAN interface. Therefore, they are not explained here again. Refer to 16.3 - LAN interface performance attributes on page 694 for a complete description of these attributes.

If CES is used, then all these common performance attributes are always 0. Refer to the <modularIf>/ces object to see the CES performance attributes (16.5.3 - CES performance attributes on page 710).

16.8.2 G703 interface performance attributes

This section describes the following performance attributes:

- telindus1431Router/g703/h2G703Performance on page 720
- telindus1431Router/g703/h24G703Performance on page 720
- telindus1431Router/g703/d7G703Performance on page 720
- telindus1431Router/g703/g703Performance on page 720
- telindus1431Router/g703/h2G826Performance on page 721
- telindus1431Router/g703/h24G826Performance on page 721
- telindus1431Router/g703/d7G826Performance on page 721
- telindus1431Router/g703/g826Performance on page 721

Refer to 16.8.1 - Common performance attributes on page 718 for an explanation of the modular user interface common performance attributes.

telindus1431Router/g703/h2G703Performance

This attribute displays the 2 hours performance summary of the G703 interface. The h2G703Performance table contains the following elements:

Element	For the corresponding period, this element displays …
sysUpTime	the elapsed time since the last cold boot.
losCount	the number of times a Loss Of Signal condition occurred.
losTime	the amount of time a Loss Of Signal condition was active.
aisCount	the number of times an Alarm Indication Signal condition occurred.
aisTime	the amount of time an Alarm Indication Signal condition was active.
lfaCount	the number of times a Loss of Frame Alignment condition occurred.
lfaTime	the amount of time a Loss of Frame Alignment condition was active.

telindus1431Router/g703/h24G703Performance

This attribute displays the 24 hours performance summary of the G703 interface. The h24G703Performance table contains the same elements as the telindus1431Router/g703/h2G703Performance table.

telindus1431Router/g703/d7G703Performance

This attribute displays the 7 days performance summary of the G703 interface. The d7G703Performance table contains the same elements as the telindus1431Router/g703/h2G703Performance table.

telindus1431Router/g703/g703Performance

This attribute displays the performance summary of the G703 interface since the last cold boot. Except for the sysUpTime, the g703Performance structure contains the same elements as the telindus1431Router/g703/h2G703Performance table.

telindus1431Router/g703/h2G826Performance

This attribute displays the 2 hours G.826 performance summary of the G703 interface. The h2G826Performance table contains the following elements:

Element	For the corresponding period, this value displays …
sysUpTime	the elapsed time since the last cold boot.
errBlocks	the number of errored blocks that was counted.
errSec	the number of errored seconds that was counted.
sevErrSec	the number of severely errored seconds that was counted.
unavailCount	the number of times the interface was down (i.e. unavailable, as defined in ITU-T recommendation G.826 Annex A).
unavailTime	the amount of time the interface was down.
bBErrors	the number of background block errors that was counted.

Also see G703 interface performance definitions on page 722.

telindus1431Router/g703/h24G826Performance

This attribute displays the 24 hours G.826 performance summary of the G703 interface. The h24G826Performance table contains the same elements as the telindus1431Router/g703/h2G826Performance table.

telindus1431Router/g703/d7G826Performance

This attribute displays the 7 days G.826 performance summary of the G703 interface. The d7G826Performance table contains the same elements as the telindus1431Router/g703/h2G826Performance table.

telindus1431Router/g703/g826Performance

This attribute displays the G.826 performance summary of the G703 interface since the last cold boot. Except for the sysUpTime, the g826Performance structure contains the same elements as the telindus1431Router/g703/h2G826Performance table.

G703 interface performance definitions

The following table lists some of the definitions that are used in the ITU-T recommendations that apply on the G703 interface. They are listed here for completeness only. For more detailed information, refer to the recommendations themselves.

Term	Definition
defect	A defect is one of the following conditions: • Loss Of Signal (LOS, defined in G.775). • Alarm Indication Signal (AIS, defined in G.775). • Loss of Frame Alignment (LFA, defined in G.706).
Errored Block (EB)	A data frame that contains one or more errors. In case of G.704 framing a frame is time slot 0 up to time slot 31.
Errored Second (ES)	A 1 second period where at least 1 EB or defect occurred.
Severely Errored Second (SES)	A 1 second period where equal to or more than 30% EBs occur or at least 1 defect. The measurement of EBs depends on the operation mode: • Framed without CRC-4: the error detection occurs based on the detected Frame Alignment Signal (FAS) bit errors; 28 FAS bit errors per second matches a Bit Error Rate (BER) of 10^{-3} or more. • Framed with CRC-4: the error detection occurs based on CRC-4.
unavailability	Matches a period of 10 or more consecutive SESs. Refer to G.826 Annex A for a complete definition.

16.9 Router performance attributes

This section discusses the performance attributes concerned with routing. First it describes the general routing performance attributes. Then it explains the performance attributes of the extra features as there are NAT, filtering, L2TP tunnelling, etc…

The following gives an overview of this section:

- 16.9.1 - General router performance attributes on page 724
- 16.9.2 - NAT performance attributes on page 731
- 16.9.3 - L2TP tunnel performance attributes on page 734
- 16.9.4 - Manual SA performance attributes on page 736
- 16.9.5 - Traffic policy performance attributes on page 738

16.9.1 General router performance attributes

This section describes the following performance attributes:

- telindus1431Router/router/routingTable on page 725
- telindus1431Router/router/radiusAuth on page 726
- telindus1431Router/router/radiusAcct on page 726
- telindus1431Router/router/pingResults on page 727
- telindus1431Router/router/tracertResults on page 727

This section describes the following actions:

- telindus1431Router/router/startPing on page 728
- telindus1431Router/router/stopPing on page 728
- telindus1431Router/router/startTracert on page 729
- telindus1431Router/router/stopTracert on page 730
- telindus1431Router/router/clearTracert on page 730

telindus1431Router/router/routingTable

This attribute lists all known routes and how many times they are used.

The routingTable contains the following elements:

Element	Description
network	This element displays the IP address of the destination network.
mask	This element displays the network mask of the destination network.
gateway	This element displays the IP address of the next router on the path to the destination network.
interface	This element displays the interface through which the destination network can be reached. Possible values are: • internal. The own protocol stack is used. • <name>. The destination network can be reached through this particular interface. The <name> of the interface is the name as you configured it. Note that the “interface” can also be a DLCI, an ATM PVC, a tunnel, etc. • discard. Packets for this destination are discarded.
uses	This element displays how many times the route has been used since it is listed in the routing table. For each IP packet that matches this route, the attribute value is incremented by one. RIP routes may disappear from the routing table, and re-appear afterwards. The attribute value is reset when a RIP route disappears from the routing table.

telindus1431Router/router/radiusAuth

This attribute lists the RADIUS authentication server performance information.

The radiusAuth table contains the following elements:

Element	Description
server	This element displays the IP address of the authentication server.
requests	This element displays the number of access requests that is sent to the authentication server.
accepts	This element displays the number of access accepts that is received from the authentication server.
rejects	This element displays the number of access rejects that is received from the authentication server.
challenges	This element displays the number of access challenges that is received from the authentication server.
badAuthenticators	This element displays the total number of packets that contained invalid Message-Authenticator attributes.
timeOuts	This element displays the authentication time-out.
droppedPackets	This element displays the number of incoming packets dropped for reasons other than being malformed, bad authenticators, or unknown types.

telindus1431Router/router/radiusAcct

This attribute lists the RADIUS accounting server performance information.

The radiusAcct structure contains the following elements:

Element	Description
server	This element displays the IP address of the accounting server.
requests	This element displays the number of accounting requests that is sent to the accounting server.
responses	This element displays the number of accounting responses that is received from the accounting server.
badAuthenticators	This element displays the number of packets that contained invalid Signature attributes.
timeOuts	This element displays the accounting time-out.
droppedPackets	This element displays the number of incoming packets dropped for reasons other than being malformed, bad authenticators, or unknown types.

telindus1431Router/router/pingResults

This attribute displays the results of a ping to an IP address started with the startPing action.

The pingResults structure contains the following elements:

Element	Description
ipAddress	This element displays the IP address of the host that is being pinged.
numOfTxPackets	This element displays the number of transmitted pings.
numOfRxPackets	This element displays the number of correct answers on the transmitted pings.
minReplyTime	This element displays the lowest reply time of all correct answers.
maxReplyTime	This element displays the highest reply time of all correct answers.
avrgReplyTime	This element displays the average reply time of all correct answers.

telindus1431Router/router/tracertResults

This attribute displays the results of a traceroute to an IP address/host started with the startTracert action.

The tracertResults table contains the following elements:

Element	Description
ttl	This element displays the Time To Live.
ipAddress	This element displays the IP address of the hop that has been passed.
hostName	This element displays the hostname of the hop that has been passed. Note that this only displays
nrTx	This element displays the number of traceroute queries that have been transmitted to the hop.
nrRx	This element displays the number of correct answers on the transmitted traceroute queries that have been received from the hop.
minRtt	This element displays the minimum Round-Trip Time that has been measured.
maxRtt	This element displays the maximum Round-Trip Time that has been measured.
avrgRtt	This element displays the average Round-Trip Time that has been calculated.
successRate	This element displays the success rate. It is the ratio of nrRx/nrTx expressed in percents.
comment	This element displays some comments. E.g. Destination reached, Maximum number of hops reached, etc.

telindus1431Router/router/startPing

Use this action to start transmitting pings to an IP address or host. The result of the ping can be seen in the pingResults attribute. Refer to telindus1431Router/router/pingResults on page 727.

The argument value structure of the startPing action contains the following elements:

Argument	Description
ipAddress	Use this element to specify the IP address of the host you want to ping. Default:0.0.0.0 Range: up to 255.255.255.255 If you fill in the ipAddress element you may omit the hostName element.
hostName	Use this element to specify the hostname of the host you want to ping. Default:<empty> Range: 0 ... 255 characters If you fill in the hostName element you may omit the ipAddress element.
sourceIp	Use this element to specify the source IP address. Default:0.0.0.0 Range: up to 255.255.255.255 This can be used to force the source address to be something other than the IP address of the interface on which the traceroute query is sent. If this IP address is not one of the Telindus 1431 SHDSL CPE interface addresses, then nothing is sent.
iterations	Use this element to specify the number of pings. Default:5 Range: 0 ... If you set the iterations element to 0, then the host is pinged an indefinite number of times. The only way to stop the ping session is by executing the stopPing action.
interval	Use this element to specify the interval, in seconds, between consecutive pings. Default:1 Range: 0 ... 100
dataLength	Use this element to specify the length, in bytes, of the data transmitted in a ping. Default:31 Range: 0 ... 1300
timeOut	Use this element to specify the time-out period. Default:00000d 00h 00m 05s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s If a ping is sent, the Telindus 1431 SHDSL CPE waits during this time-out period on the answer. If the answer is received … • within this time-out period, then ping is considered successful. • outside this time-out period, then the ping is considered unsuccessful.

telindus1431Router/router/stopPing

Use this action to stop pending pings.

telindus1431Router/router/startTracert

Use this action to start a traceroute to an IP address or host. The result of the traceroute can be seen in the tracertResults attribute. Refer to telindus1431Router/router/tracertResults on page 727.

The argument value structure of the startTracert action contains the following elements:

Argument	Description
ipAddress	Use this element to specify the IP address of the host you want to trace. Default:0.0.0.0 Range: up to 255.255.255.255 If you fill in the ipAddress element you may omit the hostName element.
hostName	Use this element to specify the hostname of the host you want to trace. Default:<empty> Range: 0 ... 255 characters If you fill in the hostName element you may omit the ipAddress element.
sourceIp	Use this element to specify the source IP address. Default:0.0.0.0 Range: up to 255.255.255.255 This can be used to force the source address to be something other than the IP address of the interface on which the traceroute query is sent. If this IP address is not one of the Telindus 1431 SHDSL CPE interface addresses, then nothing is sent.
startTtl	Use this element to specify from which TTL onwards you want to see the traceroute results. Default:1 Range: 1 ... 255 For example, if you set the startTtl element to 5, then the traceroute result displayed in the tracertResult attribute starts from TTL number 5. 1 up to 4 is not displayed.
maxHops	Use this element to specify the maximum number of hops. Default:30 Range: 1 ... 255 If the maximum number of hops is reached but the destination host is still not reached, then the last traceroute result displays the comment "Maximum number of hops reached". The default of 30 hops is the same default used for TCP connections.
queriesPerHop	Use this element to specify how many traceroute queries have to be sent to each hop. Default:3 Range: 1 ... 65536
resolveHosts	Use this element to enable or disable the resolving of hop IP addresses to hostnames. Default:enabled Range: enabled / disabled If you set the resolveHosts elements to … • enabled (default), then the hostName element in the tracertResults attribute displays the hostname of the hop. • disabled, then the hostName element in the tracertResults attribute remains empty.
dnsTimeOut	Use this element to set the DNS time-out. Default:00000d 00h 00m 03s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s When hop IP addresses are resolved to hostnames, then the DNS replies are expected within this time-out period. Else they are no longer accepted.

Argument	Description
icmpTimeOut	Use this element to set the ICMP time-out. When a hop is queried, then the ICMP replies are expected within this time-out period. Else they are no longer accepted. Default:00000d 00h 00m 03s Range: 00000d 00h 00m 00s - 24855d 03h 14m 07s
tos	Use this element to set the Type Of Service in the traceroute query. This can be used to investigate whether different service types result in different paths. Useful values are 16 (low delay) and 8 (high throughput). Default:0 Range: 0 ... 255
packetLength	Use this element to set the traceroute query datagram length in bytes. Default:32 Range: 32 ... 1300

telindus1431Router/router/stopTracert

Use this action to stop pending traceroute queries.

telindus1431Router/router/clearTracert

Use this action to clear the tracertResults table.

16.9.2 NAT performance attributes

This section describes the following performance attributes:

- telindus1431Router/router/defaultNat/socketsFree on page 732
- telindus1431Router/router/defaultNat/allocFails on page 732
- telindus1431Router/router/defaultNat/discards on page 732
- telindus1431Router/router/defaultNat/addressesAvailable on page 732
- telindus1431Router/router/defaultNat/tcpSocketsUsed on page 732
- telindus1431Router/router/defaultNat/udpSocketsUsed on page 732
- telindus1431Router/router/defaultNat/icmpSocketsUsed on page 732
- telindus1431Router/router/defaultNat/tcpAllocs on page 733
- telindus1431Router/router/defaultNat/udpAllocs on page 733
- telindus1431Router/router/defaultNat/icmpAllocs on page 733

This section describes the following actions:

- telindus1431Router/router/defaultNat/reset on page 733

telindus1431Router/router/defaultNat/socketsFree

This attribute shows the remaining number of new connections (i.e. sockets) that can be initiated. A socket is a set of source and destination IP addresses and port numbers.

Initially, 2048 simultaneous sockets can be initiated. Sockets are freed using a garbage mechanism. This means that every five minutes all sockets are checked. If a socket has been released by PAT or NAT, then this socket is returned to the pool of free sockets.

ICMP and UDP sockets are released when they have no data traffic during five minutes. TCP sockets are released after the TCP session has been closed or when the session has been idle for 24 hours.

telindus1431Router/router/defaultNat/allocFails

If no sockets are available anymore but an attempt to set up a new connection is being made, then the natAllocFails attribute value is incremented by 1.

Because the sockets are distributed using a hashing function, it is possible that natAllocFails increases even though natSocketsFree still indicates free sockets.

ICMP requires a new socket for each transmitted packet. This implies that, for instance, a permanent ping or trace-route command may eventually use all free sockets.

telindus1431Router/router/defaultNat/discards

This attribute indicates how many times a packet has been discarded for reasons other than a lack of free sockets. This could be, for instance, because an attempt was made to connect from the Internet to a service that was not present in the servicesAvailable table.

telindus1431Router/router/defaultNat/addressesAvailable

This attribute displays the number of NAT addresses that are currently free.

telindus1431Router/router/defaultNat/tcpSocketsUsed

This attribute displays the number of sockets currently in use by PAT and NAT for TCP applications.

telindus1431Router/router/defaultNat/udpSocketsUsed

This attribute displays the number of sockets currently in use by PAT and NAT for UDP applications.

telindus1431Router/router/defaultNat/icmpSocketsUsed

This attribute displays the number of sockets currently in use by PAT and NAT for ICMP applications.

telindus1431Router/router/defaultNat/tcpAllocs

This attribute indicates how many TCP sockets have been allocated since cold boot. Together with the performance attributes natUdpAllocs and natIcmpAllocs it gives an indication of the type of traffic that is being routed.

telindus1431Router/router/defaultNat/udpAllocs

This attribute indicates how many UDP sockets have been allocated since cold boot. Together with the performance attributes natTcpAllocs and natIcmpAllocs it gives an indication of the type of traffic that is being routed.

telindus1431Router/router/defaultNat/icmpAllocs

This attribute indicates how many ICMP sockets have been allocated since cold boot. Together with the performance attributes natTcpAllocs and natUdpAllocs it gives an indication of the type of traffic that is being routed.

telindus1431Router/router/defaultNat/reset

Use this action to release all sockets currently in use and return them to the free socket pool.

In other words, executing this action resets all NAT/PAT sessions that are currently established. It also releases all official IP addresses that are dynamically assigned to a private IP address. If any TCP sessions are still active, these sessions will be aborted.

Take care when using this action! All TCP information is lost when the sockets are released with this action. Any TCP sessions in use at the time of the reset will go into a hang-up state. These applications will need to restart.

16.9.3 L2TP tunnel performance attributes

This section describes the following performance attributes:

- telindus1431Router/router/tunnels/l2tpTunnels on page 735
- telindus1431Router/router/tunnels/ipsecL2tpTunnels on page 735

telindus1431Router/router/tunnels/l2tpTunnels

This attribute displays the performance information of the L2TP tunnels.

The l2tpTunnels table contains the following elements:

Element	Description
name	This is the name of the tunnel as you configured it.
mibCounters	This displays the SNMP MIB2 parameters of the tunnel. These are the same as the SNMP MIB2 parameters on the LAN interface. Refer to 16.3 - LAN interface performance attributes on page 694.

telindus1431Router/router/tunnels/ipsecL2tpTunnels

This attribute displays the performance information of the L2TP tunnels.

The ipsecL2tpTunnels table contains the same elements as the l2tpTunnels table. Refer to telindus1431Router/router/tunnels/l2tpTunnels on page 735.

16.9.4 Manual SA performance attributes

This section describes the following performance attributes:

- telindus1431Router/router/manualSA[ ]/inPackets on page 737
- telindus1431Router/router/manualSA[ ]/outPackets on page 737
- telindus1431Router/router/manualSA[ ]/espDecryptionFailure on page 737
- telindus1431Router/router/manualSA[ ]/espAuthenticationFailure on page 737
- telindus1431Router/router/manualSA[ ]/espSequenceNrReplay on page 737
- telindus1431Router/router/manualSA[ ]/espDroppedFrames on page 737

telindus1431Router/router/manualSA[ ]/inPackets

Upon receipt of a (reassembled) packet containing an ESP Header, the receiver determines the appropriate SA, based on the destination IP address, security protocol (ESP), and the SPI. Once the appropriate SA is determined, the inPackets attribute is incremented for this SA.

telindus1431Router/router/manualSA[ ]/outPackets

ESP is applied to an outbound packet only after it is determined that the packet is associated with an SA that calls for ESP processing. Once the appropriate SA is determined, the outPackets attribute is incremented for this SA.

telindus1431Router/router/manualSA[ ]/espDecryptionFailure

This attribute displays the number of times the decryption of an incoming ESP packet failed.

telindus1431Router/router/manualSA[ ]/espAuthenticationFailure

This attribute displays the number of times the authentication of an incoming ESP packet failed.

telindus1431Router/router/manualSA[ ]/espSequenceNrReplay

For each incoming ESP packet, the receiver verifies that the packet contains a sequence number that does not duplicate the sequence number of any other packets received during the life of this SA. Should this be the case, then these packets are dropped and the espSequenceNrReplay attribute is incremented for this SA.

telindus1431Router/router/manualSA[ ]/espDroppedFrames

This attribute displays the number of ESP packets that were successfully decrypted and authenticated, but that could not be delivered to the L2TP tunnel (e.g. because the tunnel was down) and had to be dropped.

16.9.5 Traffic policy performance attributes

This section describes the following performance attributes:

- telindus1431Router/router/trafficPolicy[ ]/discards on page 739
- telindus1431Router/router/trafficPolicy[ ]/trafficShaping on page 739

telindus1431Router/router/trafficPolicy[ ]/discards

This attribute indicates how many packets have been discarded based on the criteria that are defined by the IP traffic policy.

telindus1431Router/router/trafficPolicy[ ]/trafficShaping

This attribute shows the usage of each line in the traffic shaping table.

The trafficShaping table contains the following elements:

Element	Description
name	This is the name of the line in the traffic shaping table as you configured it.
uses	This is the number of times this line in the traffic shaping table is used.
sourceIpStart-Address	This is the IP source address range as you configured it. Packets that fall within the specified range are forwarded and queued if applicable.
sourceIpEnd-Address	
destinationIpStart-Address	This is the IP destination address range as you configured it. Packets that fall within the specified range are forwarded and queued if applicable.
destinationIpEnd-Address	
tosStartValue	This is the TOS range as you configured it. Packets that fall within the specified range are forwarded and queued if applicable.
tosEndValue	
ipProtocol	This is the protocol field as you configured it. Packets that have the specified protocol field are forwarded and queued if applicable.
sourcePortStart	This is the source port range as you configured it. Packets that fall within the specified range are forwarded and queued if applicable.
sourcePortEnd	
destinationPortStart	This is the destination port range as you configured it. Packets that fall within the specified range are forwarded and queued if applicable.
destinationPortEnd	
newTosValue	This is the new TOS value as you configured it.
priority	This is the destination queue as you configured it. In case an overload condition occurs, then a packet that matches an entry in the trafficShaping table is sent to the specified queue.

16.10 Bridge performance attributes

This section discusses the performance attributes concerned with bridging. First it describes the general bridging performance attributes. Then it explains the performance attributes of the extra features as there are access listing, etc…

The following gives an overview of this section:

- 16.10.1 - Bridge group performance attributes on page 741
- 16.10.2 - Bridge access list performance attributes on page 744

16.10.1 Bridge group performance attributes

This section describes the following performance attributes:

- telindus1431Router/bridge/bridgeGroup/bridgeCache on page 742
- telindus1431Router/bridge/bridgeGroup/bridgeDiscards on page 742
- telindus1431Router/bridge/bridgeGroup/bridgeFloods on page 742
- telindus1431Router/bridge/bridgeGroup/multiVlans on page 742
- telindus1431Router/bridge/bridgeGroup/vlanSwitching on page 743

telindus1431Router/bridge/bridgeGroup/bridgeCache

When a port of the bridge enters the learning state, it stores the MAC addresses of the stations situated on the network that is connected to this port. The MAC addresses are stored in a MAC address database or bridge cache. The bridgeCache attribute visualises this address database. Refer to What is the bridge cache? on page 539 for more information.

The bridgeCache table contains the following elements:

Element	Description
interface	This is the interface through which the station can be reached.
macAddress	This is the MAC address of the station situated on the network connected to the interface.
rxCount	This is the number of frames received from the corresponding MAC address.
txCount	This is the number of frames forwarded to the corresponding MAC address.

telindus1431Router/bridge/bridgeGroup/bridgeDiscards

This attribute displays the number of times a frame was discarded because …

- it was received on the same interface as the one through which the destination address can be reached.
- it was received on an interface that is not in the forwarding state.

telindus1431Router/bridge/bridgeGroup/bridgeFloods

This attribute displays the number of times a frame was flooded on all interfaces because …

- it was a broadcast / multicast.
- the position of the station with the destination MAC address was not known (yet).

telindus1431Router/bridge/bridgeGroup/multiVlans

This attribute displays the SNMP MIB2 performance parameters of the VLANs that are present on the bridge group.

The multiVlans table contains the following elements:

Element	Description
name	This element displays the name of the VLAN as you configured it.
vlan	This element displays the VLAN ID.
mibCounters	This element displays the SNMP MIB2 performance parameters of the VLAN. Refer to 16.3 - LAN interface performance attributes on page 694 for an explanation of the individual SNMP MIB2 performance parameters.

telindus1431Router/bridge/bridgeGroup/vlanSwitching

This attribute displays the performance information of the VLAN switching process.

The vlanSwitching table contains the following elements:

Element	Description
sourceIntf	This element displays the name of the source interface.
sourceVlan	This element displays the VLAN ID of the source VLAN.
destinationIntf	This element displays the name of the destination interface.
destinationVlan	This element displays the VLAN ID of the destination VLAN.
uses	This element displays the number of packets that have been switched.

16.10.2 Bridge access list performance attributes

This section describes the following performance attributes:

- telindus1431Router/bridge/accessList[ ]/bridgeAccessList on page 745

telindus1431Router/bridge/accessList[ ]/bridgeAccessList

This attribute shows information on the use of the bridge access list.

The bridgeAccessList table contains the following elements:

Element	Description
macAddress	This is the MAC address as configured in the configuration attribute telindus1431Router/bridge/accessList[ ]/bridgeAccessList.
uses	This indicates the number of times a packet has been discarded for the corresponding MAC address.

16.11 Management performance attributes

This section describes the following performance attributes:

- telindus1431Router/management/cms2SessionCount on page 747
- telindus1431Router/management/cliSessionCount on page 747
- telindus1431Router/management/tftpSessionCount on page 748
- telindus1431Router/management/tcpSessionCount on page 748
- telindus1431Router/management/ipStackEvents on page 748

telindus1431Router/management/cms2SessionCount

This attribute displays the number of CMS2 sessions that are currently active on the Telindus 1431 SHDSL CPE.

There are always minimum two fixed sessions active. Connecting with TMA, TMA CLI, Telnet, etc. opens additional sessions. This is explained in the following table:

Session count	Purpose
1 fixed session	A fixed session for SNMP.
1 fixed session	A fixed session for O10.
+ 2 sessions	When connecting with TMA.
+ 1 session	When connecting with TMA for HP OpenView or the Alarm Manager.
+ 1 session	When connecting with TMA CLI.
+ 2 sessions	When downloading a *config.cli* or *config.cms* file.
+ 1 session	When connecting with Telnet.
+ 1 session	When downloading software.
+ 1 session	When connecting with the Web Interface.

telindus1431Router/management/cliSessionCount

This attribute displays the number of CLI sessions that are currently active on the Telindus 1431 SHDSL CPE.

There are always minimum two fixed sessions active. Connecting with TMA CLI, the Web Interface, etc. opens additional sessions. This is explained in the following table:

Session count	Purpose
1 fixed session	A fixed session for the control port.
1 fixed session	A fixed session for Web Interface.
+ 1 session	When connecting with TMA CLI or starting a CLI session.
+ 1 session	When connecting with the Web Interface.

telindus1431Router/management/tftpSessionCount

This attribute displays the number of TFTP sessions that are currently active on the Telindus 1431 SHDSL CPE.

telindus1431Router/management/tcpSessionCount

This attribute displays the number of TCP sessions that are currently active on the Telindus 1431 SHDSL CPE. The following table shows when a TCP session opens:

Session count	Purpose
+ 1 session	When connecting with Telnet.
+ 1 session	When connecting with the Web Interface.

telindus1431Router/management/ipStackEvents

This attribute gives an indication of the internal load of the protocol stack.

16.12 Operating system performance attributes

This section describes the following performance attributes:

- telindus1431Router/operatingSystem/currUsedProcPower on page 750
- telindus1431Router/operatingSystem/usedProcPower on page 750
- telindus1431Router/operatingSystem/freeDataBuffers on page 750
- telindus1431Router/operatingSystem/totalDataBuffers on page 750
- telindus1431Router/operatingSystem/largestFreeBlockSize on page 750
- telindus1431Router/operatingSystem/freeBlockCount on page 750
- telindus1431Router/operatingSystem/freeMemory on page 751
- telindus1431Router/operatingSystem/totalMemory on page 751
- telindus1431Router/operatingSystem/taskInfo on page 751

telindus1431Router/operatingSystem/currUsedProcPower

This attribute displays the amount of processing power used during the last 650 milliseconds, expressed as a percentage of the total available processing power.

telindus1431Router/operatingSystem/usedProcPower

This attribute lists the used processing power for the 11 most recent 30 seconds intervals. The processing power is expressed as a percentage of the total processing power.

The usedProcPower table contains the following elements:

Element	Description
sysUpTime	This is the elapsed time since the last cold boot. The next values are for the 30 seconds period before this relative time stamp.
min	This is the minimum percentage of processing power in use during the last 30 seconds.
average	This is the average percentage of processing power in use during the last 30 seconds.
max	This is the maximum percentage of processing power in use during the last 30 seconds.

telindus1431Router/operatingSystem/freeDataBuffers

The processor uses buffers for storing the packets during processing and/or queuing. Each buffer has a 256 byte size, headers included. This attribute is the number of data buffers currently not in use and available for e.g. incoming data.

telindus1431Router/operatingSystem/totalDataBuffers

This attribute displays the total number of available data buffers.

telindus1431Router/operatingSystem/largestFreeBlockSize

The processor uses RAM memory for storing internal information and buffering. The different tasks allocate RAM memory on request. Tasks may also free memory again. In this way the total RAM memory becomes fragmented. This attribute gives the size of the largest contiguous free memory block expressed in bytes.

telindus1431Router/operatingSystem/freeBlockCount

This attribute displays the number of free contiguous memory blocks.

telindus1431Router/operatingSystem/freeMemory

This attribute displays the total free memory expressed in bytes.

telindus1431Router/operatingSystem/totalMemory

This attribute displays the total RAM memory expressed in bytes.

telindus1431Router/operatingSystem/taskInfo

This attribute contains status information concerning the different tasks running on the processor. It is a table grouping up to 31 task slots, which is the maximum number of parallel tasks running on the processor's operating system.

This attribute contains the same elements as the status attribute telindus1431Router/operatingSystem/taskInfo on page 684.

17 Alarm attributes

This chapter discusses the alarm attributes of the Telindus 1431 SHDSL CPE. The following gives an overview of this chapter:

- 17.1 - Alarm attributes overview on page 754
- 17.2 - Introducing the alarm attributes on page 756
- 17.3 - General alarms on page 759
- 17.4 - LAN interface alarms on page 761
- 17.5 - WAN interface alarms on page 762
- 17.6 - SHDSL line alarms on page 763
- 17.7 - SHDSL line pair alarms on page 764
- 17.8 - End alarms on page 766
- 17.9 - G703 interface alarms on page 768
- 17.10 - G703 channel alarms on page 769
- 17.11 - Serial interface alarms on page 770
- 17.12 - Router alarms on page 771

17.1 Alarm attributes overview

> telindus1431Router
totalAlarmLevel
alarmInfo
notResponding
alarmSyncLoss
configChanged
access
unknownStatus
coldBoot
warmBoot
codeConsistencyFail
configConsistencyFail

>> lanInterface
alarmInfo
linkDown

>> wanInterface
alarmInfo
linkDown

>>> line
alarmInfo
linkDown

>>>> linePair[ ]
alarmInfo
linkDown
lineAttenuation
signalNoise
errSecExceeded
sevErrSecExceeded

>>> end

>>>> linePair[ ]
alarmInfo
lineAttenuation
signalNoise
errSecExceeded
sevErrSecExceeded

```
>> g703
   alarmInfo
        linkDown
        lfa
        ais
        sq
        testActive
```

```
    >>> channel[g703_1]
        alarmInfo
            linkDown
```

```
    >>> transpChannel[ ]
        alarmInfo
            linkDown
```

```
>> <serialIf>
   alarmInfo
        linkDown
        testActive
```

```
>> router
   alarmInfo
        pingActive
```

17.2 Introducing the alarm attributes

Before discussing the alarm attributes of the Telindus 1431 SHDSL CPE in detail, some general information on the alarm attributes of the Telindus 1431 SHDSL CPE is given.

The following gives an overview of this chapter:

- 17.2.1 - Configuration alarm attributes on page 757
- 17.2.2 - General alarm attributes on page 758

17.2.1 Configuration alarm attributes

This section describes the following alarm attributes:

- telindus1431Router/.../alarmMask
- telindus1431Router/.../alarmLevel

telindus1431Router/.../alarmMask

Use this attribute to mask or unmask the alarms of an object. This determines whether an active alarm is forwarded to the central management system (e.g. HP OpenView) or not.

The alarms in the alarmMask attribute have the following values:

Value	Is the active alarm being forwarded to the central management system?
enabled	Yes. So the alarm is *unmasked*.
disabled	No. So the alarm is *masked*.

Alarms are always seen in the alarmInfo alarm attribute of an object, regardless of the masking of the alarm. I.e. even if an alarm is set to disabled in the alarmMask of an object, if the alarm condition is fulfilled then the alarm will be set to on in the alarmInfo of that object. However, because this alarm is disabled it will not be sent to the central management system (e.g. HP OpenView).

Only the most important alarms are unmasked (i.e. enabled) by default. All other alarms are masked (i.e. disabled).

telindus1431Router/.../alarmLevel

Use this attribute to assign a priority level to each alarm of the corresponding object. The alarm level range goes from 0 to 254, where 0 is the lowest and 254 is the highest priority level.

The alarmLevel of an unmasked, active alarm is sent to the totalAlarmLevel alarm attribute of the top object telindus1431Router.

17.2.2 General alarm attributes

This section describes the following alarm attributes:

- telindus1431Router/totalAlarmLevel
- telindus1431Router/.../alarmInfo

telindus1431Router/totalAlarmLevel

This attribute is only present in the top object of the containment tree of the Telindus 1431 SHDSL CPE, being telindus1431Router.

It displays the priority level of an unmasked, active alarm. When several alarms are generated at the same time, the highest priority level is shown. If the alarm levels are set in a structured manner, one look at the totalAlarmLevel attribute enables the operator to make a quick estimation of the problem.

The value of the totalAlarmLevel attribute is also communicated to the central management system (e.g. HP OpenView) where it determines the colour of the icon. This colour is an indication of the severity of the alarm.

telindus1431Router/.../alarmInfo

This attribute contains the actual alarm information of the corresponding object.

The alarmInfo structure contains the following elements:

Element	This element displays for the corresponding object …
discriminator	the total alarm count since the last cold boot.
currentAlarms	the current alarms.
previousAlarms	the second most recent alarms.
alarmMask	the alarmMask as you configured it.
alarmLevel	the alarmLevel as you configured it.

17.3 General alarms

This section describes the alarms of the alarm attribute telindus1431Router/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/alarmInfo

The different alarms related to the telindus1431Router object together with their explanation and default alarmMask and alarmLevel value are given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
notResponding	by the management concentrator when the Telindus 1431 SHDSL CPE does not respond on its polling session.	enabled	4
alarmSyncLoss	when the internal alarm buffer overflows.	enabled	4
configChanged	when the local configuration has been changed.	disabled	1
access	when a management session is started on the Telindus 1431 SHDSL CPE itself. This alarm is not activated when the management session is established through a management concentrator. **Example** The alarm is *activated* in case of … • a TMA, TMA CLI, terminal (CLI or ATWIN) or Easy-Connect session via the control connector of the Telindus 1431 SHDSL CPE. • a TMA, TMA CLI, TMA for HP OpenView, Telnet (CLI or ATWIN), HTTP (Web Interface) or TFTP session using the LAN / WAN IP address of the Telindus 1431 SHDSL CPE. The alarm is *not activated* in case of … • any management session (TMA, terminal, Telnet, HTTP, etc.) established *through a management concentrator* on the Telindus 1431 SHDSL CPE. • SNMP management.	disabled	1
unknownState	each time a new Telindus 1431 SHDSL CPE is added to the network and before the management concentrator has completed a first successful polling session.	disabled	0
coldBoot	each time the Telindus 1431 SHDSL CPE performs a cold boot.	disabled	1
warmBoot	each time the Telindus 1431 SHDSL CPE performs a warm boot.	disabled	1

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
codeConsistency-Fail	when the software consistency imposed by the management concentrator on the Telindus 1431 SHDSL CPE fails. For example, because of a loss of contact. In the management concentrator that manages the Telindus 1431 SHDSL CPE (e.g. the Orchid 1003 LAN, Telindus 1035 Orchid, etc.), check the status attribute nmsgroup/softConsistencyStatus to determine the problem.	disabled	1
configConsistency-Fail	when the configuration consistency imposed by the management concentrator on the Telindus 1431 SHDSL CPE fails. For example, because of a loss of contact. In the management concentrator that manages the Telindus 1431 SHDSL CPE (e.g. the Orchid 1003 LAN, Telindus 1035 Orchid, etc.), check the status attribute status attributes nmsgroup/objectTable/configState and configDiag to determine the problem.	disabled	1

17.4 LAN interface alarms

This section describes the alarms of the alarm attribute telindus1431Router/lanInterface/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/lanInterface/alarmInfo

The alarm related to the lanInterface object together with its explanation and default alarmMask and alarmLevel value is given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
linkDown	when no valid LAN data is detected. I.e. when the connection between the interface and the LAN is down.	enabled	3

17.5 WAN interface alarms

This section describes the alarms of the alarm attribute telindus1431Router/wanInterface/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/wanInterface/alarmInfo

The alarm related to the wanInterface object together with its explanation and default alarmMask and alarmLevel value is given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
linkDown	when an error situation is detected in the encapsulation protocol. For instance, no ATM synchronisation, a failed PPP authentication, …	enabled	3

17.6 SHDSL line alarms

This section describes the alarms of the alarm attribute telindus1431Router/wanInterface/line/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/wanInterface/line/alarmInfo

The alarms related to the line object together with their explanation and default alarmMask and alarmLevel value are given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
linkDown	when the line is down. I.e. no data can be transmitted over the line.	enabled	3

17.7 SHDSL line pair alarms

This section describes the alarms of the alarm attribute telindus1431Router/wanInterface/line/linePair[ ]/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/wanInterface/line/linePair[ ]/alarmInfo

The alarms related to the linePair[ ] object together with their explanation and default alarmMask and alarmLevel value are given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
linkDown	when the line pair is down. I.e. no data can be transmitted over the line pair.	disabled	3
lineAttenuation	when the line attenuation exceeds the value configured in the telindus1431Router/wanInterface/line/linkAlarmThresholds for at least 10 seconds. The alarm is cleared when the line attenuation drops below this value for at least 10 seconds. Note that in case the telindus1431Router/wanInterface/line/eocHandling attribute is set to alarmConfiguration, the central SHDSL device forces the remote SHDSL device to use the linkAlarmThresholds/lineAttenuation as configured on the central device. For more information, refer to … • 5.4.3 - Controlling the standard EOC message exchange on page 74 • 5.4.4 - Which standard EOC information is retrieved? on page 76	disabled	1
signalNoise	when the signal noise exceeds the value configured in the telindus1431Router/wanInterface/line/linkAlarmThresholds for at least 10 seconds. The alarm is cleared when the signal noise drops below this value for at least 10 seconds. Note that in case the telindus1431Router/wanInterface/line/eocHandling attribute is set to alarmConfiguration, the central SHDSL device forces the remote SHDSL device to use the linkAlarmThresholds/signalNoise as configured on the central device. For more information, refer to … • 5.4.3 - Controlling the standard EOC message exchange on page 74 • 5.4.4 - Which standard EOC information is retrieved? on page 76	disabled	1

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
errSecExceeded	when the amount of erroneous seconds exceeds the value configured in the telindus1431Router/wanInterface/line/linkAlarmThresholds within a 15 minutes period[1]. The alarm is cleared when the amount of erroneous seconds drops below this value within a 15 minutes period.	disabled	1
sevErrSecExceeded	when the amount of severely erroneous seconds exceeds the value configured in the telindus1431Router/wanInterface/line/linkAlarmThresholds within a 15 minutes period[1]. The alarm is cleared when the amount of severely erroneous seconds drops below this value within a 15 minutes period.	disabled	2

1. The 15 minutes periods run synchronous with the 15 minutes periods of the telindus1431Router/wanInterface/line/h2Line performance attribute.
   Because alarms are raised or cleared within 15 minutes periods, there is a delay in the alarm status. For example, suppose that in the first minute of a 15 minutes period the errSecOn value is exceeded, then the errSecExceeded alarm is raised. The alarm stays on for the remainder of the 15 minutes period. The alarm is only cleared if also in the next 15 minutes period the errSecOn value is not exceeded.

17.8 End alarms

This section describes the alarms of the alarm attribute telindus1431Router/wanInterface/end/linePair[ ]/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/wanInterface/end/linePair[ ]/alarmInfo

The alarm related to the end/linePair[ ] object together with its explanation and default alarmMask and alarmLevel value is given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
lineAttenuation	when the lineAttenuation value configured in the telindus1431Router/wanInterface/line/linkAlarmThresholds *of the local device* is exceeded for at least 10 seconds. The alarm is cleared when the line attenuation drops below this value for at least 10 seconds. Note however that in case the telindus1431Router/wanInterface/line/eocHandling attribute is set to alarmConfiguration, the central SHDSL device forces the remote SHDSL device to use the linkAlarmThresholds/lineAttenuation as configured on the central device. For more information, refer to … • 5.4.3 - Controlling the standard EOC message exchange on page 74 • 5.4.4 - Which standard EOC information is retrieved? on page 76	disabled	1
signalNoise	when the signalNoise value configured in the telindus1431Router/wanInterface/line/linkAlarmThresholds *of the local device* is exceeded for at least 10 seconds. The alarm is cleared when the signal noise drops below this value for at least 10 seconds. Note however that in case the telindus1431Router/wanInterface/line/eocHandling attribute is set to alarmConfiguration, the central SHDSL device forces the remote SHDSL device to use the linkAlarmThresholds/signalNoise as configured on the central device. For more information, refer to … • 5.4.3 - Controlling the standard EOC message exchange on page 74 • 5.4.4 - Which standard EOC information is retrieved? on page 76	disabled	1

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
errSecExceeded	when the errSecOn value configured in the telindus1431Router/wanInterface/line/linkAlarmThresholds *of the local device* is exceeded within a 15 minutes period[1]. The alarm is cleared when the amount of erroneous seconds drops below this value within a 15 minutes period.	disabled	1
sevErrSecExceeded	when the sevErrSecOn value configured in the telindus1431Router/wanInterface/line/linkAlarmThresholds *of the local device* is exceeded within a 15 minutes period[1]. The alarm is cleared when the amount of severely erroneous seconds drops below this value within a 15 minutes period.	disabled	2

1. The 15 minutes periods run synchronous with the 15 minutes periods of the telindus1431Router/wanInterface/line/h2Line performance attribute.
   Because alarms are raised or cleared within 15 minutes periods, there is a delay in the alarm status. For example, suppose that in the first minute of a 15 minutes period the errSecOn value is exceeded, then the errSecExceeded alarm is raised. The alarm stays on for the remainder of the 15 minutes period. The alarm is only cleared if also in the next 15 minutes period the errSecOn value is not exceeded.

17.9 G703 interface alarms

This section describes the alarms of the alarm attribute telindus1431Router/g703/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/g703/alarmInfo

The alarms related to the g703 object together with their explanation and default alarmMask and alarmLevel value are given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
linkDown	when the incoming data is no longer present. E.g. the connection *from* the WAN *towards* the Telindus 1431 SHDSL CPE is interrupted.	disabled	3
ais	when the AIS signal (also called *all ones*) is detected on the incoming data. AIS means there is an alarm occurring on the line upstream from the equipment that is connected to the G.703 interface.	disabled	2
lfa	when the Frame Alignment Signal (FAS), which is present in time slot 0 of the G.704 framed data, is not detected after a certain period. This alarm is also generated when the crc4Insertion attribute is set to enabled, but no CRC is present in the incoming data. This does not apply when crc4Insertion is set to auto.	disabled	2
sq	when the sqThreshold value, i.e. the number of erroneous seconds, is exceeded within the sqTime. For example, if 10 (default) or more erroneous seconds occur within 1 minute (default), then a signal quality alarm is generated. For more information, refer to … • telindus1431Router/g703/sqThreshold on page 462 • telindus1431Router/g703/sqTime on page 462	disabled	2
testActive	when an interface test is active.	disabled	1

17.10 G703 channel alarms

This section describes the alarms of the alarm attribute telindus1431Router/g703/channel[ ]/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/g703/channel[ ]/alarmInfo

The alarm related to the g703/channel[ ] object together with its explanation and default alarmMask and alarmLevel value is given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
linkDown	when an error situation is detected in the encapsulation protocol (Frame Relay or CES).	enabled	3

17.11 Serial interface alarms

This section describes the alarms of the alarm attribute telindus1431Router/<serialIf>/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/<serialIf>/alarmInfo

The alarm related to the <serialIf> object together with its explanation and default alarmMask and alarmLevel value is given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
linkDown	• when no data is present. E.g. the connection between the WAN and the Telindus 1431 SHDSL CPE is interrupted. • when an error situation is detected in the encapsulation protocol (Frame Relay or CES).	enabled	3
testActive	when an interface test is active.	disabled	2

17.12 Router alarms

This section describes the alarms of the alarm attribute telindus1431Router/router/alarmInfo.

Refer to 17.2 - Introducing the alarm attributes on page 756 for general information on the alarm attributes.

telindus1431Router/router/alarmInfo

The alarm related to the router object together with its explanation and default alarmMask and alarmLevel value is given in the following table:

The alarm …	is generated …	Default value	
		alarmMask	alarmLevel
pingActive	when a ping is pending (for example, an indefinite ping). This notification is necessary because you can only transmit one ping at a time. Furthermore, there is no protection when a new ping is started before the previous is stopped.	enabled	3

18 TMA sub-system picture

The sub-system picture is a TMA tool that visualises the status information of the Telindus 1431 SHDSL CPE. This chapter explains how to display the sub-system picture, and how to interpret the visual indications.

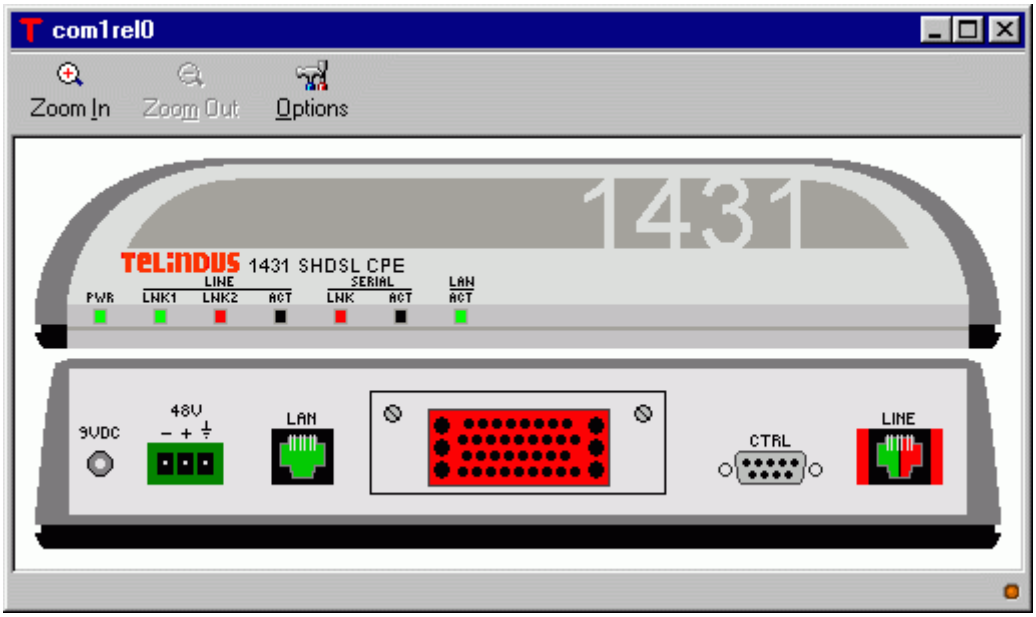
How to display the sub-system picture?

To display the sub-system picture of the Telindus 1431 SHDSL CPE, click on the sub-system picture button located in the TMA toolbar: .

Structure of the sub-system picture

This paragraph displays and labels the different elements of the sub-system picture. It also explains how the visual indications should be interpreted.

Below, the Telindus 1431 SHDSL CPE sub-system picture is displayed:



The following table gives an overview of the sub-system picture elements and what they indicate:

Element	Description
LEDs	These reflect the actual status of the device. The LED indication on the sub-system picture corresponds with the LED indication on the Telindus 1431 SHDSL CPE itself. Refer to 2.7 - The front panel LED indicators on page 24 for more information on the interpretation of the LEDs.
interfaces	This reflects the status of the interfaces. The possible indications are: • green. There is no alarm active in the corresponding interface object. • red. An alarm is active in the corresponding interface object. The colours of the interfaces only change if the alarms related to the interface object are set to *enabled* in the alarmMask.

Element	Description
LAN	This reflects the status of the LAN interface. The possible indications are: • green. There is no alarm active in the corresponding lanInterface object. • red. An alarm is active in the corresponding lanInterface object. The colour of the LAN interface only changes if the alarms related to the lanInterface object are set to *enabled* in the alarmMask.
LINE	This reflects the status of the WAN interface and of the line pair(s). The possible indications are: • green outside. There is no alarm active in the corresponding wanInterface object. • red outside. An alarm is active in the corresponding wanInterface object. • green inside, left. There is no alarm active in the corresponding linePair[1] object. • red inside, left. An alarm is active in the corresponding linePair[1] object. • green inside, right. There is no alarm active in the corresponding linePair[2] object. • red inside, right. An alarm is active in the corresponding linePair[2] object. The colours of the WAN interface / line pair(s) only change if the alarms related to the wanInterface / linePair[ ] objects are set to *enabled* in the alarmMask.

19 Auto installing the Telindus 1431 SHDSL CPE

Auto-install includes a number of features that allow you to partially or completely configure the Telindus 1431 SHDSL CPE without on-site intervention. This is shown in this chapter.

The following gives an overview of this chapter:

- 19.1 - Introducing the auto-install protocols on page 776
- 19.2 - Auto-install on the LAN interface on page 778
- 19.3 - Auto-install on the WAN interface on page 783
- 19.4 - Creating a configuration file on page 789
- 19.5 - Restoring a configuration file on page 796

19.1 Introducing the auto-install protocols

The Telindus 1431 SHDSL CPE uses several protocols during its auto-install sequence. These are introduced below.

What is BootP?

BootP (RFC 951) is used by IP devices that have no IP address to obtain one.

The client IP device sends a limited broadcast request on its interfaces requesting an IP address. The request contains the client its MAC address, which is a unique identifier (refer to What is the ARP cache? on page 394 for more information).

A workstation with a BootP server interprets incoming BootP requests. You can configure a file on the server with MAC address and IP address/subnet mask pairs for all devices in the network you want to service. If the MAC address in the BootP request matches a MAC address in this file, the BootP server replies with the corresponding IP address and subnet mask.

Assigning an IP address in this way is done through a simple request - response handshake.

The Telindus 1431 SHDSL CPE, being a router, always requests a static IP address.

What is DHCP?

DHCP (RFC 2131 and RFC 2132) is used by IP devices that have no IP address to obtain one.

The client IP device sends a limited broadcast request on its interfaces requesting an IP address. The request contains the client its MAC address, which is a unique identifier (refer to What is the ARP cache? on page 394 for more information).

A workstation with a DHCP server works in a similar way as with a BootP server. The difference with BootP is that you can additionally configure a list of IP addresses on the server. These IP addresses are dynamically assigned to the IP devices requesting an IP address, independently of their MAC address. Those address assignments are limited in time.

Assigning an IP address in this way is done through a 4-way handshake and with regular renewals.

The Telindus 1431 SHDSL CPE, being a router, always requests a static IP address.

What is DNS?

The Domain Name Service (DNS) is an Internet service that translates domain names into IP addresses. Because domain names are alphabetic, they are easier to remember. The Internet however, is really based on IP addresses. Therefore, every time you use a domain name, a DNS service must translate the name into the corresponding IP address. For example, the domain name www.mywebsite.com might translate to 198.105.232.4.

The DNS system is, in fact, its own network. If one DNS server doesn't know how to translate a particular domain name, it asks another one, and so on, until the correct IP address is returned.

What is TFTP?

Trivial File Transfer Protocol (TFTP) is an Internet software utility for transferring files that is simpler to use than the File Transfer Protocol (FTP) but less capable. It is used where user authentication and directory visibility are not required. TFTP uses the User Datagram Protocol (UDP) rather than the Transmission Control Protocol (TCP). TFTP is described formally in Request for Comments (RFC) 1350.

TFTP is typically used in combination with BootP or DHCP to obtain the configuration of a device from a TFTP server. The configuration file on this TFTP can be in a binary or an ASCII (CLI) format. How to build such files is explained in 19.4 - Creating a configuration file on page 789.

The Telindus 1431 SHDSL CPE as relay agent

Being broadcast packets, BootP, DHCP, DNS and TFTP requests can cross a router using IP helper addresses. The Telindus 1431 SHDSL CPE is a relay agent for these protocols. This means it adds additional information to the request packets allowing servers on distant networks to send back the answer.

19.2 Auto-install on the LAN interface

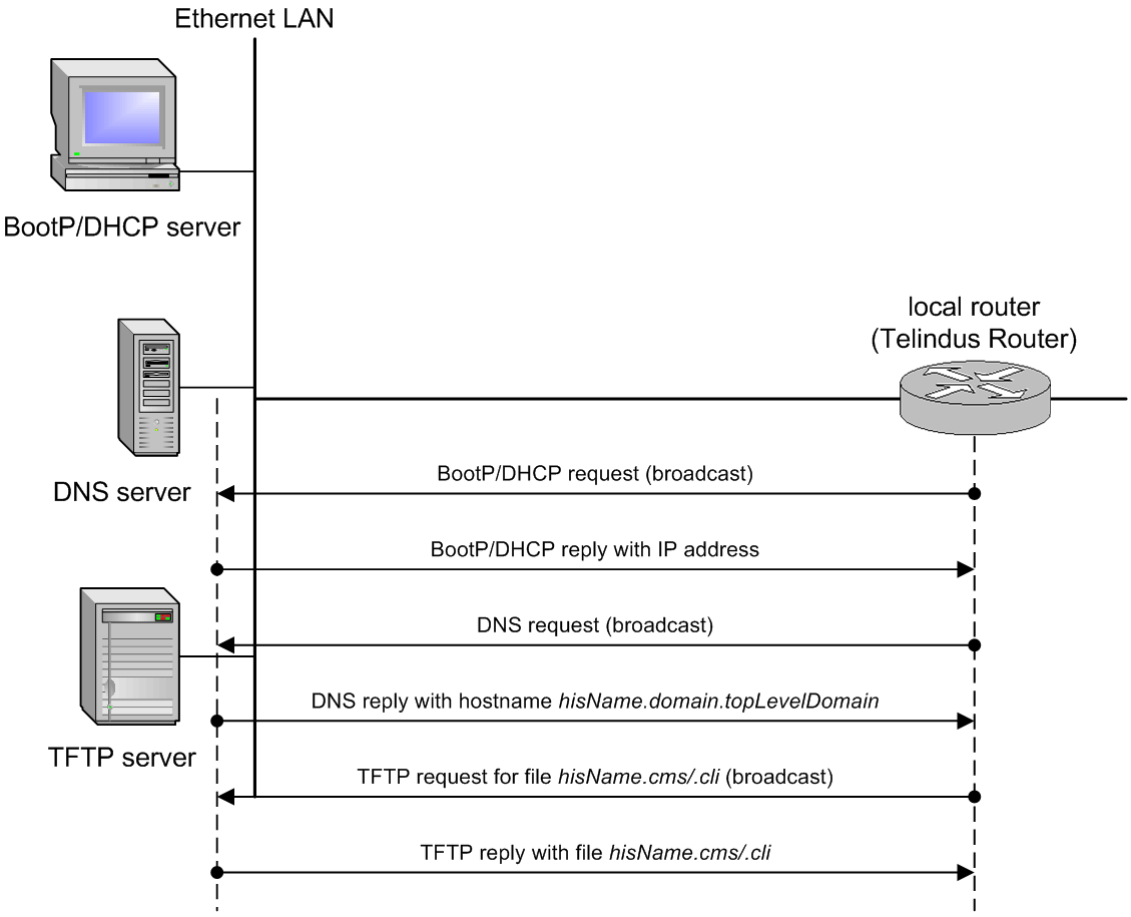
This section shows the auto-install sequence on the Telindus 1431 SHDSL CPE its LAN interface.

The following gives an overview of this section:

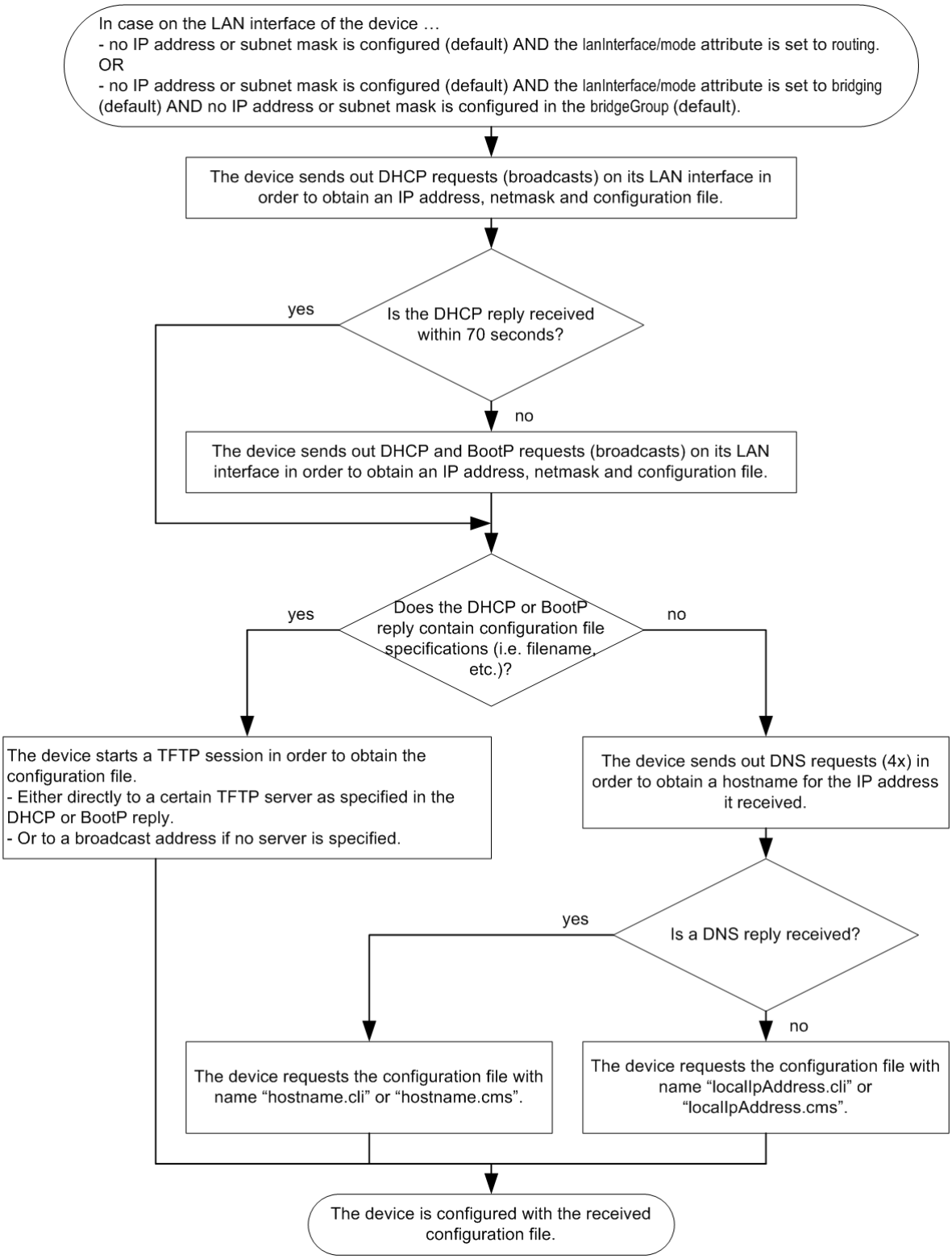
- 19.2.1 - Set-up for auto-install on the LAN interface on page 779
- 19.2.2 - Auto-install in case of Ethernet on page 780
- 19.2.3 - Example of auto-install on the LAN interface on page 781

19.2.1 Set-up for auto-install on the LAN interface

The following figure shows the set-up for auto-install on the LAN interface:



19.2.2 Auto-install in case of Ethernet


In case on the LAN interface of the device …
- no IP address or subnet mask is configured (default) AND the lanInterface/mode attribute is set to routing.
OR
- no IP address or subnet mask is configured (default) AND the lanInterface/mode attribute is set to bridging (default) AND no IP address or subnet mask is configured in the bridgeGroup (default).
The device sends out DHCP requests (broadcasts) on its LAN interface in order to obtain an IP address, netmask and configuration file.
Is the DHCP reply received within 70 seconds?
yes
no
The device sends out DHCP and BootP requests (broadcasts) on its LAN interface in order to obtain an IP address, netmask and configuration file.
Does the DHCP or BootP reply contain configuration file specifications (i.e. filename, etc.)?
yes
no
The device starts a TFTP session in order to obtain the configuration file.
- Either directly to a certain TFTP server as specified in the DHCP or BootP reply.
- Or to a broadcast address if no server is specified.
The device sends out DNS requests (4x) in order to obtain a hostname for the IP address it received.
Is a DNS reply received?
yes
no
The device requests the configuration file with name “hostname.cli” or “hostname.cms”.
The device requests the configuration file with name “localIpAddress.cli” or “localIpAddress.cms”.
The device is configured with the received configuration file.

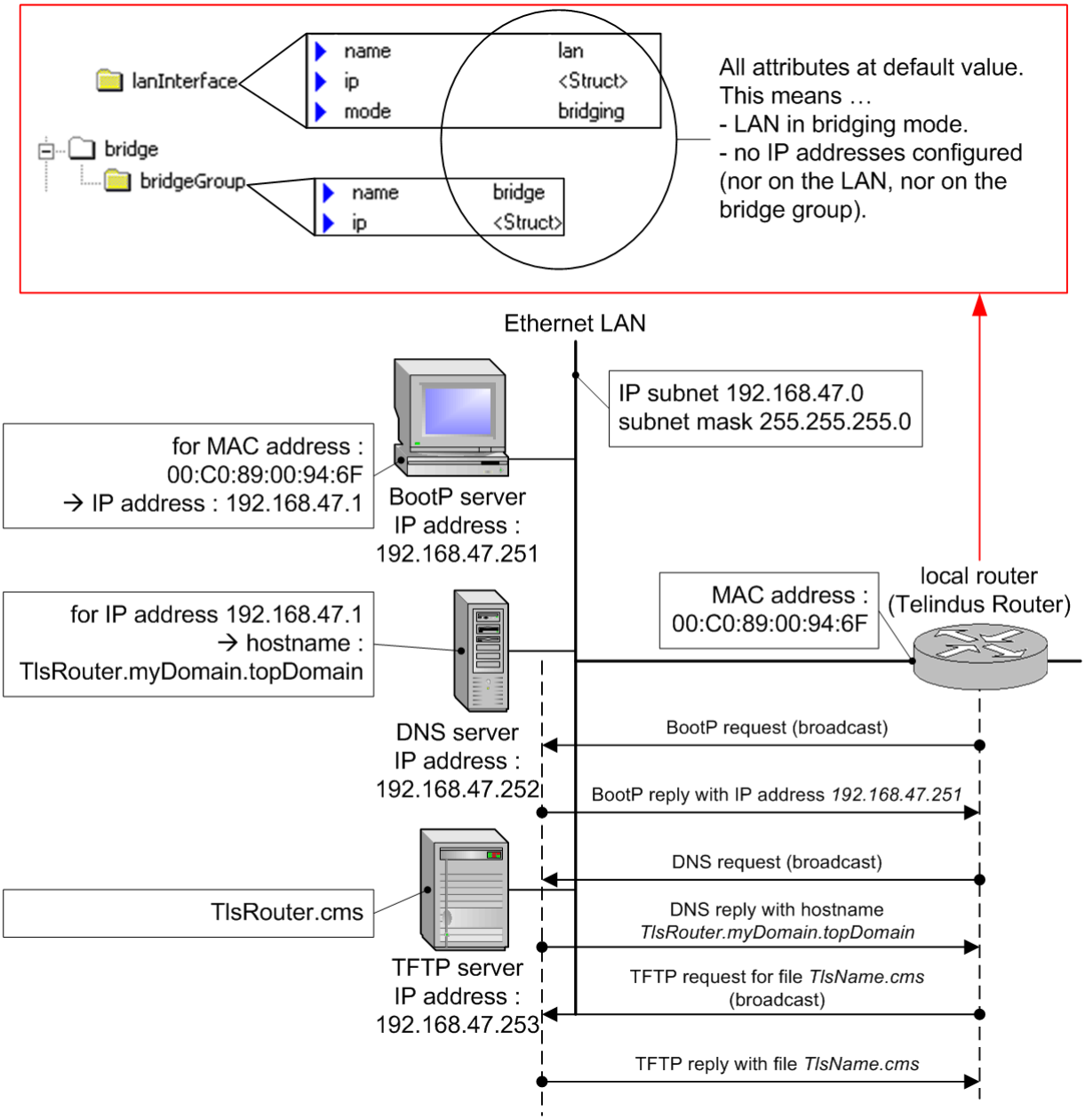
19.2.3 Example of auto-install on the LAN interface

Suppose you have the following situation:

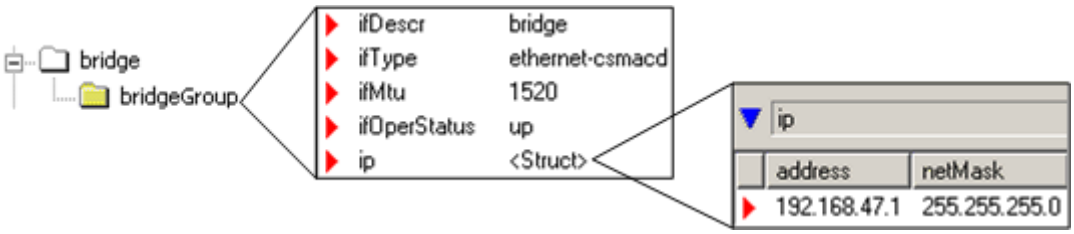
- The Telindus 1431 SHDSL CPE is still in its default configuration (absolutely nothing is configured). This means that the LAN interface …
  - is in bridging mode.
  - no IP address is configured on the LAN interface.
  - no IP address is configured on the bridge group.

  ⇒This means that if an IP address is obtained through BootP/DHCP, then it will be assigned to the bridge group, not to the LAN interface itself (since it is in bridging mode)!
- A BootP server is present on the LAN, containing the Telindus 1431 SHDSL CPE MAC address (00:C0:89:00:94:6F) and a corresponding IP address (192.168.47.1).
- A DNS server is present on the LAN, containing the Telindus 1431 SHDSL CPE its hostname "*TlsRouter*".
- A TFTP server is present on the LAN, containing the Telindus 1431 SHDSL CPE its binary configuration file "*TlsRouter.cms*".
- The Telindus 1431 SHDSL CPE is plugged on to the LAN.

The following shows how the Telindus 1431 SHDSL CPE obtains an IP address and its configuration file:



Note again that the obtained IP address is assigned to the bridge group, not to the LAN interface itself (since it is in bridging mode)! So if you check the status of the bridge group, you will see the IP address there:



19.3 Auto-install on the WAN interface

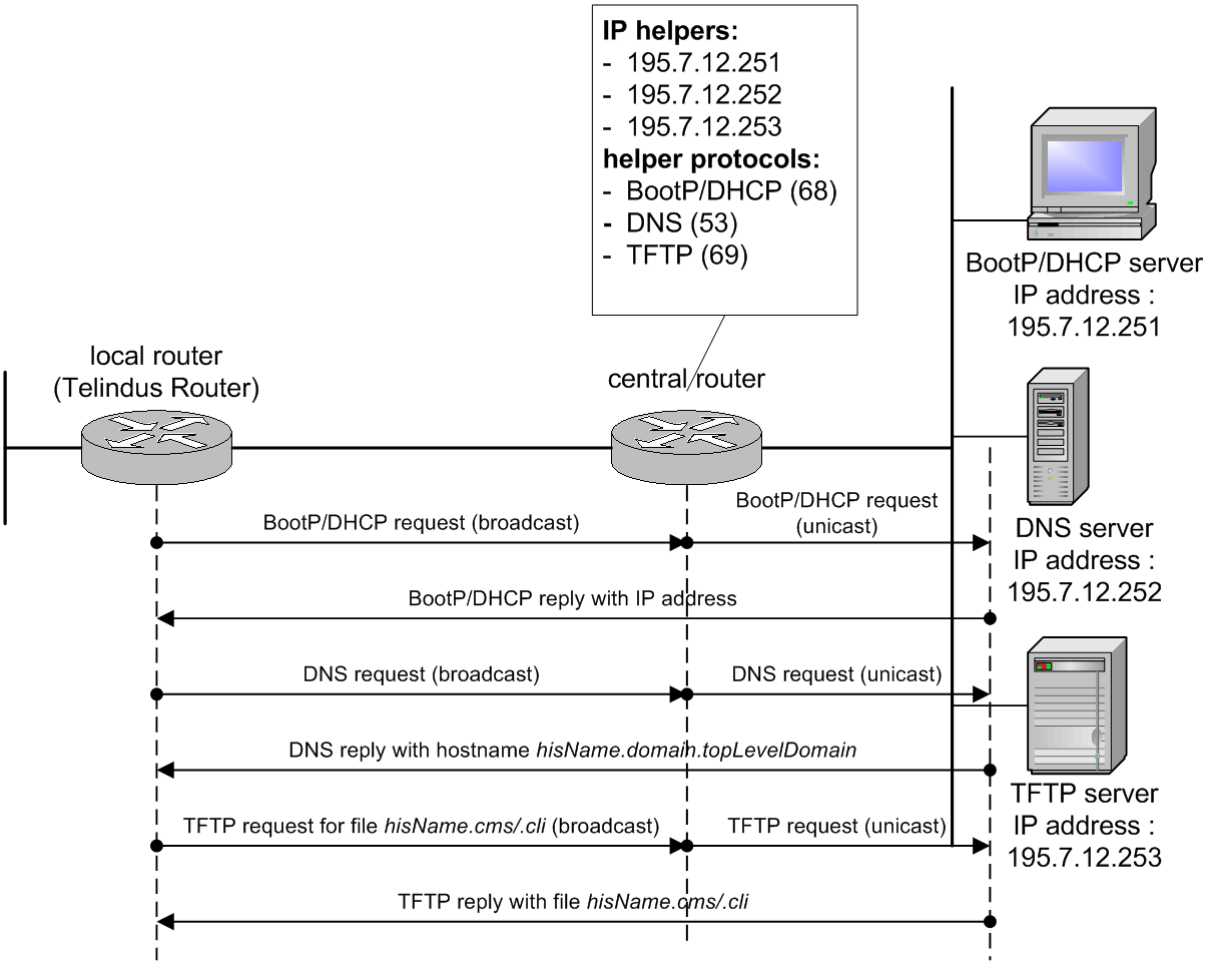
This section shows the auto-install sequence on the Telindus 1431 SHDSL CPE its WAN interface.

The following gives an overview of this section:

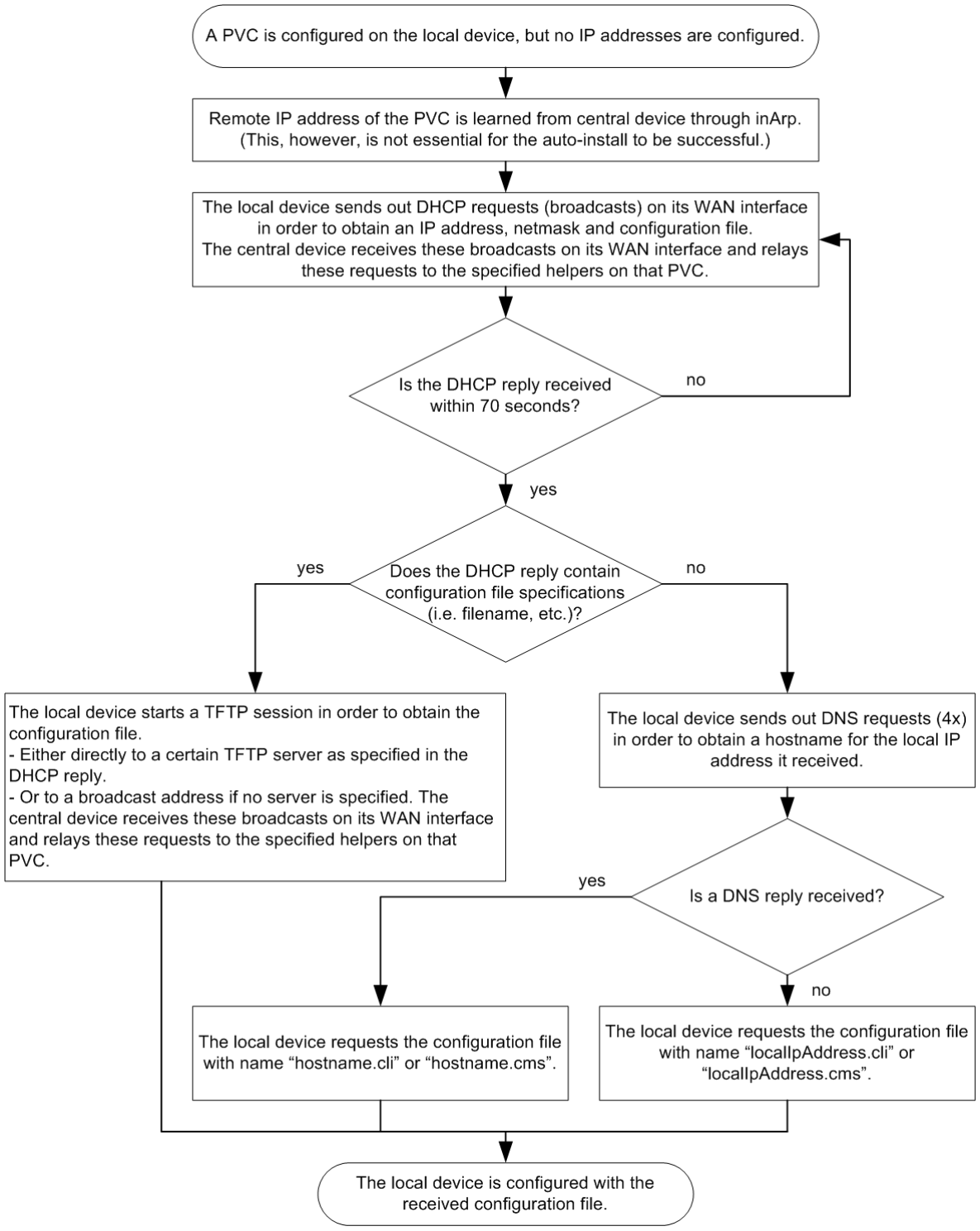
- 19.3.1 - Set-up for auto-install on the WAN interface on page 784
- 19.3.2 - Auto-install in case of ATM on page 785
- 19.3.3 - Example of auto-install on the WAN interface running ATM on page 786

19.3.1 Set-up for auto-install on the WAN interface

The following figure shows the set-up for auto-install on the WAN interface:



19.3.2 Auto-install in case of ATM

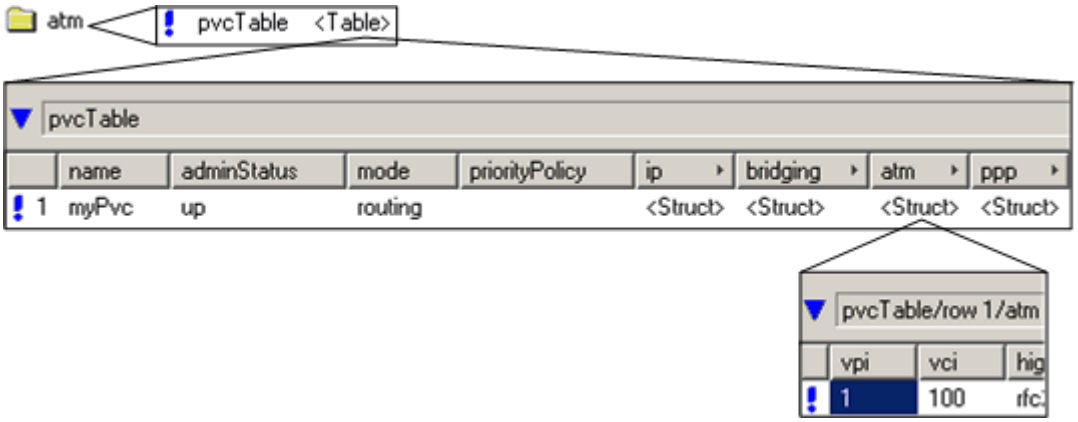

A PVC is configured on the local device, but no IP addresses are configured.
Remote IP address of the PVC is learned from central device through inArp. (This, however, is not essential for the auto-install to be successful.)
The local device sends out DHCP requests (broadcasts) on its WAN interface in order to obtain an IP address, netmask and configuration file. The central device receives these broadcasts on its WAN interface and relays these requests to the specified helpers on that PVC.
Is the DHCP reply received within 70 seconds?
no
yes
Does the DHCP reply contain configuration file specifications (i.e. filename, etc.)?
yes
no
The local device starts a TFTP session in order to obtain the configuration file.
- Either directly to a certain TFTP server as specified in the DHCP reply.
- Or to a broadcast address if no server is specified. The central device receives these broadcasts on its WAN interface and relays these requests to the specified helpers on that PVC.
The local device sends out DNS requests (4x) in order to obtain a hostname for the local IP address it received.
Is a DNS reply received?
yes
no
The local device requests the configuration file with name “hostname.cli” or “hostname.cms”.
The local device requests the configuration file with name “localIpAddress.cli” or “localIpAddress.cms”.
The local device is configured with the received configuration file.

19.3.3 Example of auto-install on the WAN interface running ATM

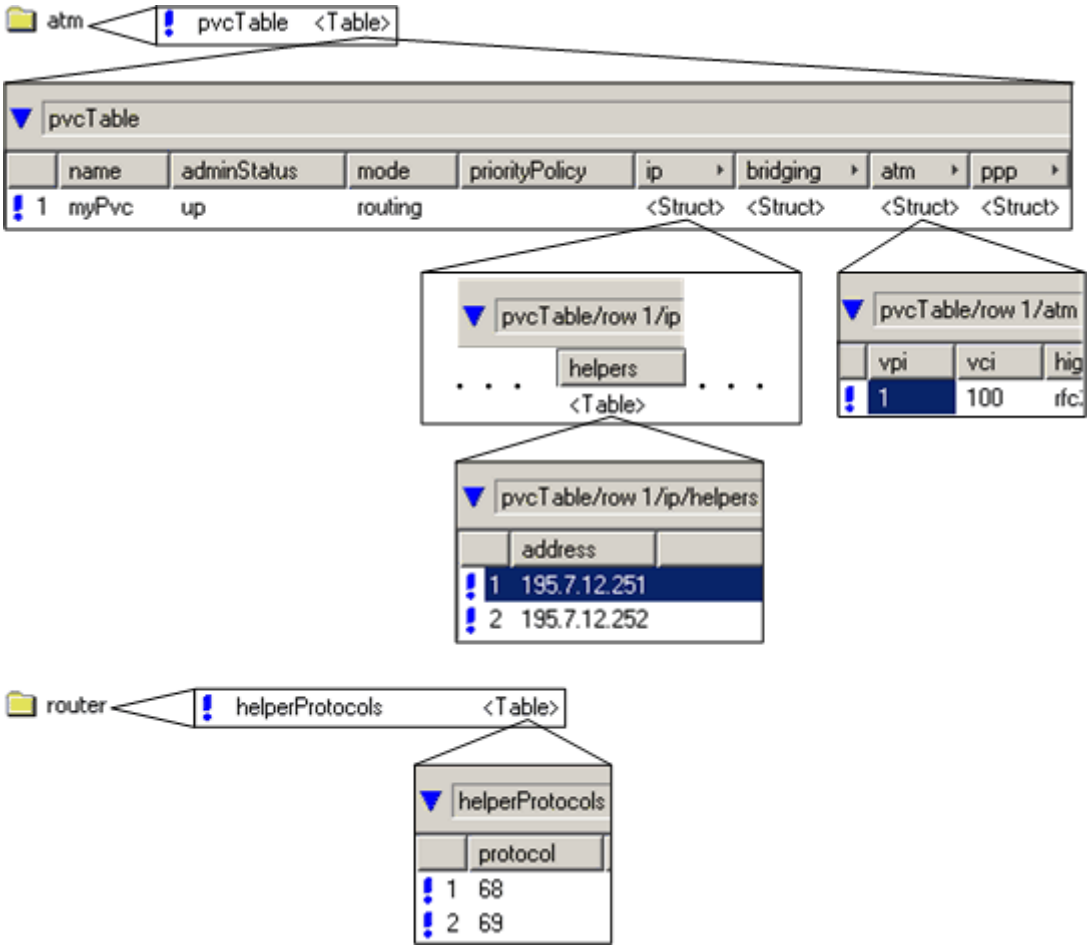
Suppose you have the following situation:

- On the local Telindus Router you add an ATM PVC to the atm/pvcTable. For this ATM PVC you specify the VPI/VCI values 1/100. All other elements of the ATM PVC remain at their default value.
- On the central Telindus Router you also add an ATM PVC to the atm/pvcTable. For this ATM PVC you specify …
  - the VPI/VCI values 1/100.
  - the helper IP addresses 192.168.47.251 (DHCP server) and 192.168.47.252 (TFTP server).
  - the helper protocols DHCP (68) and TFTP (69).
- A DHCP server is present on the remote network, containing the Telindus 1431 SHDSL CPE MAC address (00:C0:89:00:94:6F), a corresponding IP address (192.168.100.1) and a corresponding configuration filename "*TlsRouterConfig.cms*".
- A TFTP server is present on the remote network, containing the Telindus 1431 SHDSL CPE its binary configuration file "*TlsRouterConfig.cms*".
- The Telindus Router is plugged on to the WAN.

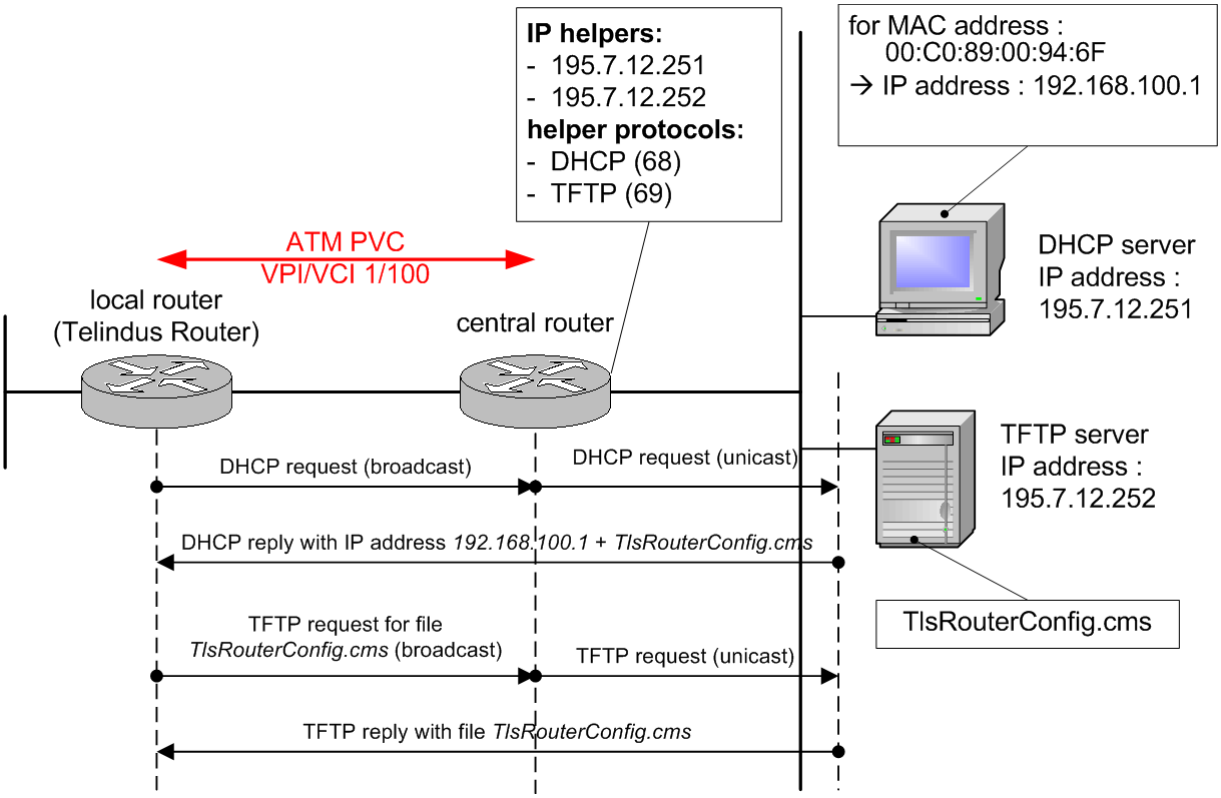
So the initial configuration on the local Telindus Router is as shown below:



In order for the auto-install of the local Telindus Router to be successful, the following must be configured on the central Telindus Router:



The following shows how the local Telindus Router obtains an IP address and its configuration file:



19.4 Creating a configuration file

In 19.2 - Auto-install on the LAN interface on page 778 and 19.3 - Auto-install on the WAN interface on page 783, you can see how the configuration file is retrieved using TFTP during the auto-install sequence. This section explains which two configuration file formats can be used for this purpose and how to create such a configuration file.

The following gives an overview of this section:

- 19.4.1 - The different configuration file formats on page 790
- 19.4.2 - Creating a binary file using TMA on page 791
- 19.4.3 - Creating an ASCII CLI file using TMA on page 792
- 19.4.4 - Creating an ASCII CLI file using TFTP on page 794
- 19.4.5 - Creating an ASCII CLI file using Telnet on page 795

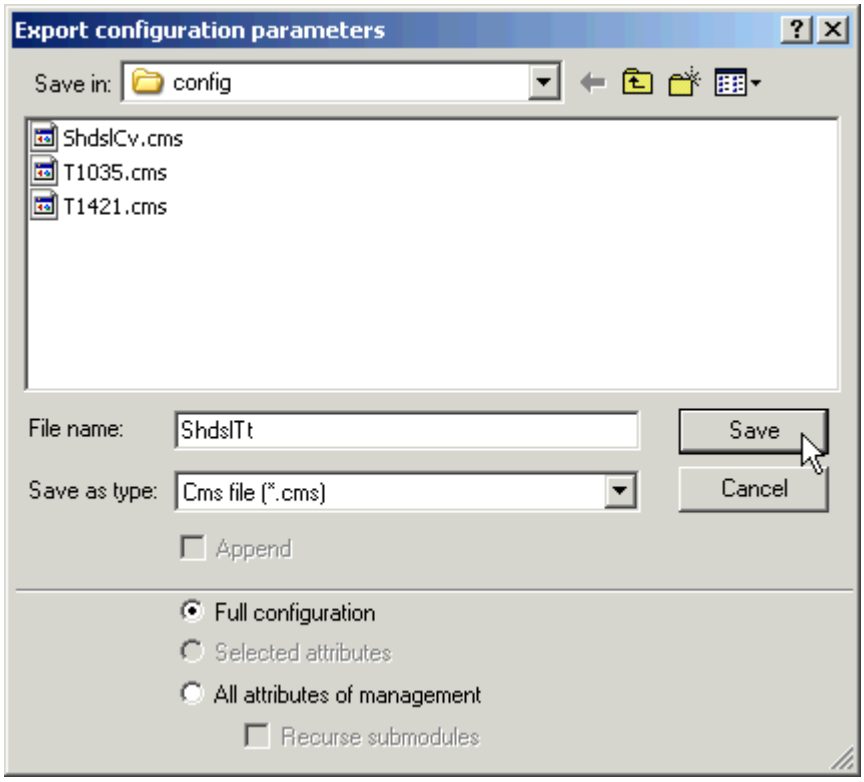
19.4.1 The different configuration file formats

In 19.2 - Auto-install on the LAN interface on page 778 and 19.3 - Auto-install on the WAN interface on page 783, you can see how the configuration file is retrieved using TFTP during the auto-install sequence. The two possible configuration file formats used for this purpose are:

File type	Extension	How to create the configuration file
binary	.cms	Use the TMA export utility and choose the CMS file type. This is the most compact format. Refer to 19.4.2 - Creating a binary file using TMA on page 791.
ASCII CLI	.cli	• Use the TMA export utility and choose the CLI file type. • Use the TFTP get command. • Use the CLI get command. Refer to … • 19.4.3 - Creating an ASCII CLI file using TMA on page 792 • 19.4.4 - Creating an ASCII CLI file using TFTP on page 794 • 19.4.5 - Creating an ASCII CLI file using Telnet on page 795 When you download an ASCII CLI (*.cli) configuration file to the Telindus 1431 SHDSL CPE, make sure that each line in this file contains no more than 500 characters.

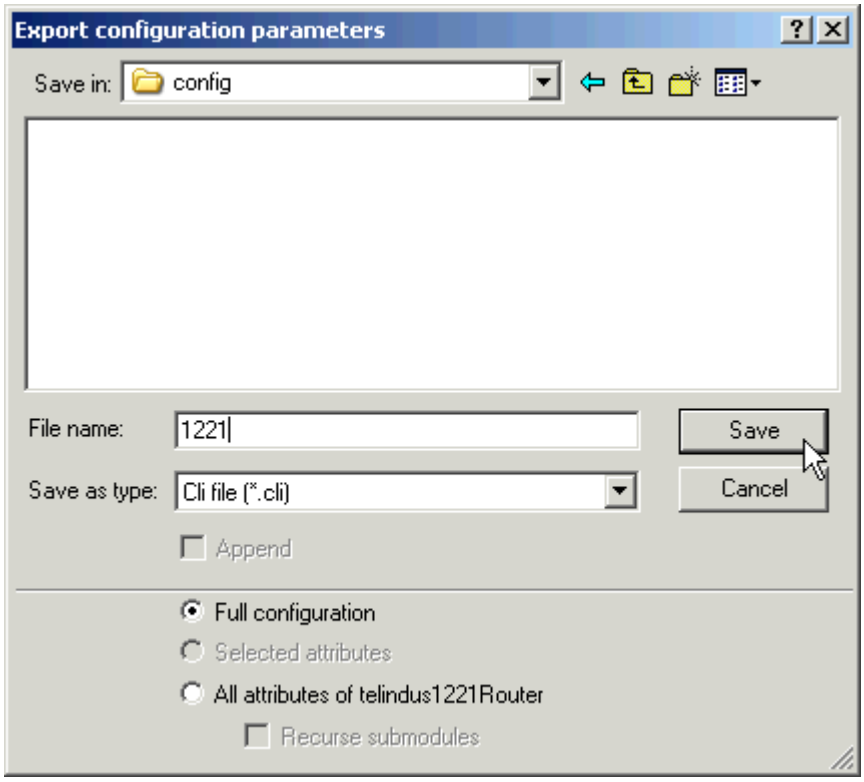
19.4.2 Creating a binary file using TMA

To create a configuration file in binary (*.*cms*) format using TMA, proceed as follows:

Step	Action
1	Start a TMA session on the Telindus 1431 SHDSL CPE.
2	Make changes to its configuration (if necessary) in order to obtain the desired configuration.
3	Click on the *Export data to file* button: .
4	In the *Export configuration parameters* window, select the following: • Choose a directory where to save the file. • Enter a name for the file. • Make sure the file type is CMS. • Make sure the *Full configuration* option is selected. 
5	Click on the *Save* button. The edited configuration of the Telindus 1431 SHDSL CPE is stored on the PC in binary format. The file contains the complete configuration including the *Activate Configuration* command. As a result, the configuration is immediately activated if you download it to the device again.

19.4.3 Creating an ASCII CLI file using TMA

To create a configuration file in ASCII CLI (**.cli*) format using TMA, proceed as follows:

Step	Action
1	Start a TMA session on the Telindus 1431 SHDSL CPE.
2	Make changes to its configuration (if necessary) in order to obtain the desired configuration.
3	Click on the *Export data to file* button: .
4	In the *Export configuration parameters* window, select the following: • Choose a directory where to save the file. • Enter a name for the file. • Make sure the file type is CLI. • Make sure the *Full configuration* option is selected.  Do not select the file extension for ASCII text (**.txt*)! This is for documentation purposes only, not for configuration purposes.

Step	Action
5	Click on the *Save* button. ⇒The edited configuration of the Telindus 1431 SHDSL CPE is stored on the PC in ASCII CLI format. The file contains the configuration attributes that differ from their default value including the *Load Default Configuration* command at the beginning of the file and the *Activate Configuration* command at the end of the file. As a result, the configuration is immediately activated if you download it to the device again.

19.4.4 Creating an ASCII CLI file using TFTP

To create a configuration file in ASCII CLI (**.cli*) format using TFTP, proceed as follows:

Step	Action
1	Start a TFTP session on the Telindus 1431 SHDSL CPE. For example by typing `tftp 10.0.11.1` at the command prompt of your workstation, where 10.0.11.1 is the IP address of the Telindus 1431 SHDSL CPE.
2	Get the configuration file of the Telindus 1431 SHDSL CPE. **Example** `tftp> get CONFIG.CLI dest_file.cli` Where … • `get` is the TFTP command to retrieve a file. • `CONFIG.CLI` (in capitals!) is the source file (i.e. the Telindus 1431 SHDSL CPE configuration file). • `dest_file.cli` is the destination file.
3	When the file transfer is finished, close the TFTP session.

Note that the procedure described above does not work with FTP.

19.4.5 Creating an ASCII CLI file using Telnet

To create a configuration file in ASCII CLI (**.cli*) format using Telnet logging and the CLI *get* command, proceed as follows:

Step	Action
1	Start a Telnet session on the Telindus 1431 SHDSL CPE. You are automatically in CLI mode.
2	You are automatically located in the top object (telindus1431Router) and in the "*Edit Configuration*" group. Check to make sure (just press the *Enter* key).
3	Log the CLI output to a file. Refer to the documentation of your Telnet software how to do so.
4	Execute the *get -r -d* command. `>get -r -d`
5	Stop the logging.

6	The log file you now obtained, modify it as follows:
	• At the beginning of the log file …
	- remove all logging before the *get -r -d* command.
	- remove the *get -r -d* command itself.
	- change the string *GET* into *SET*.
	- type the string *action "Load Default Configuration"* (case sensitive!) on the line above the *SET* command.
	• At the end of the log file…
	- remove all logging until the last character is a closing curled bracket "}".
	- type the string *action "Activate Configuration"* (case sensitive!) on the line below the closing curled bracket "}".
	~~>get -r -d~~
	action "Load Default Configuration"
	~~GET~~ SET
	{
	LIST
	{
	sysName = name
	sysContact = contact
	}
	
	etc...
	
	SELECT operatingSystem
	{
	}
	}
	action "Activate Configuration"
	~~/telindus1221Router:"Edit Configuration"~~
	~~>~~

7	Save this file to a file with an extension **.cli*.

19.5 Restoring a configuration file

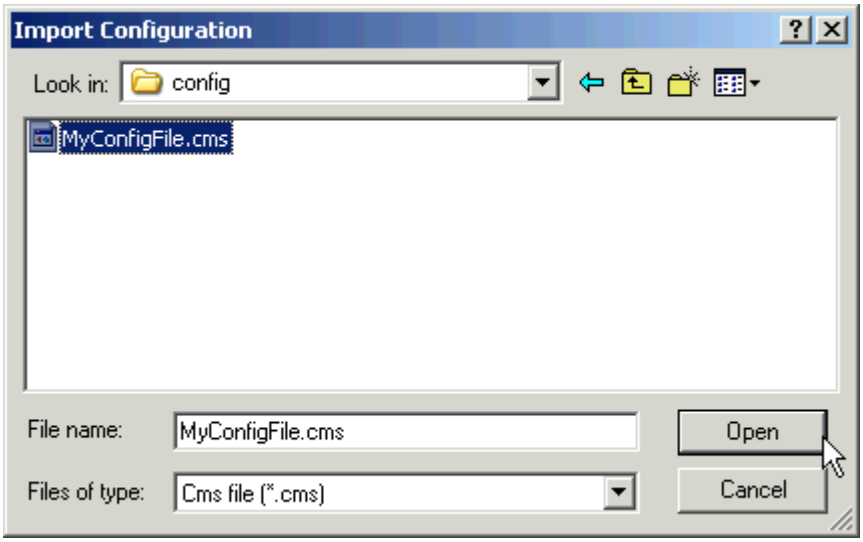
In 19.2 - Auto-install on the LAN interface on page 778 and 19.3 - Auto-install on the WAN interface on page 783, you can see how the configuration file is retrieved using TFTP during the auto-install sequence. It is, however, also possible to restore previously saved configuration files by downloading them yourself to the Telindus 1431 SHDSL CPE. You can do this by using various applications. This is explained in this section.

The following gives an overview of this section:

- 19.5.1 - Downloading a configuration file using TMA on page 797
- 19.5.2 - Downloading a configuration file using (T)FTP on page 798
- 19.5.3 - Downloading a configuration file using Telnet on page 799

19.5.1 Downloading a configuration file using TMA

To download a configuration file using TMA, proceed as follows:

Step	Action
1	Start a TMA session on the Telindus 1431 SHDSL CPE.
2	Click on the *Import data from file* button: .
3	In the *Import configuration* window, select the following: • Select the directory where the configuration file is located. • Select which type of configuration file you want to import: CMS or CLI. • Select the configuration file you want to import. 
4	Click on the *Open* button. ⇒The configuration is downloaded to the Telindus 1431 SHDSL CPE.

19.5.2 Downloading a configuration file using (T)FTP

To download a configuration file using (T)FTP, proceed as follows:

Step	Action
1	Start a (T)FTP session on the Telindus 1431 SHDSL CPE. For example by typing `(t)ftp 10.0.11.1` at the command prompt of your computer, where 10.0.11.1 is the IP address of the Telindus 1431 SHDSL CPE. If a write access password is configured on the Telindus 1431 SHDSL CPE, then enter it as well.
2	Set the transfer mode to binary (octet) format. The syntax to do this is typically `binary` or `octet`.

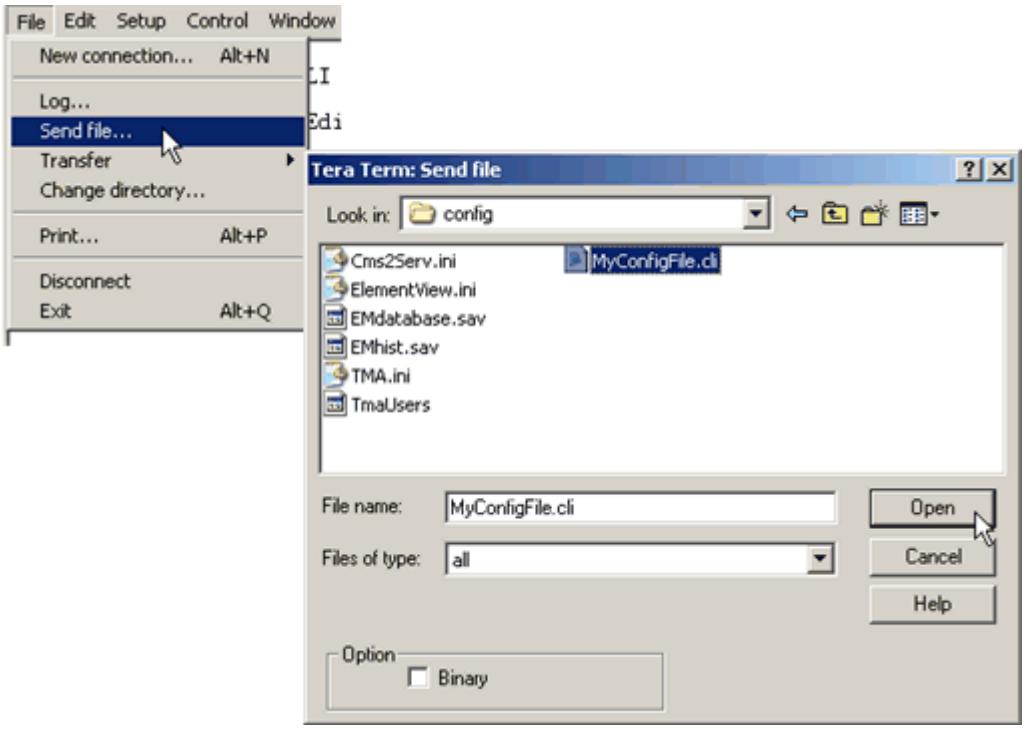
3	Type the following command:
	`(t)ftp> put source_file.cli CONFIG.CLI`
	or
	`(t)ftp> put source_file.cms CONFIG.CMS`
	Where …
	• `put` is the (T)FTP command to send a file.
	• `source_file.*` is the source file. This may either be a CLI or CMS file[1].
	• `CONFIG.*` (in capitals!) is the destination file (i.e. the Telindus 1431 SHDSL CPE configuration file). This may either be a CLI or CMS file[1].

4	When the file transfer is finished, close the (T)FTP session.

1. However, make sure that source and destination file format are both the same!

19.5.3 Downloading a configuration file using Telnet

To download a configuration file using Telnet, proceed as follows:

Step	Action
1	Start a Telnet session on the Telindus 1431 SHDSL CPE. You are automatically in CLI mode.
2	You are automatically located in the top object (telindus1431Router) and in the "*Edit Configuration*" group. Check to make sure (just press the *Enter* key).
3	Use the “send” feature of your Telnet software to send the ASCII CLI configuration file to the Telindus 1431 SHDSL CPE. Refer to the documentation of your Telnet software how to do so. 

20 Downloading software

This chapter explains how to download loader and application software to the Telindus 1431 SHDSL CPE. It also shows how to download any other file to the file system of the Telindus 1431 SHDSL CPE. But first it explains the difference between boot, loader and application software.

The following gives an overview of this chapter:

- 20.1 - What is boot, loader and application software? on page 802
- 20.2 - Downloading application software using TMA on page 804
- 20.3 - Downloading application software using TFTP on page 805
- 20.4 - Downloading application or loader software using TML on page 806
- 20.5 - Downloading application software using FTP on page 807
- 20.6 - Downloading application or loader software in loader mode on page 808
- 20.7 - Downloading files to the file system on page 809

20.1 What is boot, loader and application software?

What is boot software?

The boot software takes care of the initial phase in the start-up sequence of the Telindus 1431 SHDSL CPE. It is located on the lowest software level. If the Telindus 1431 SHDSL CPE only loads its boot software, then we say that the Telindus 1431 SHDSL CPE runs in *boot mode*.

The Telindus 1431 SHDSL CPE …

- runs in boot mode if no loader or application software is present.
- cannot be forced to run in boot mode by using a DIP switch.
- can temporarily be forced to run in boot mode by using the -b option of the TML command. Refer to 20.4 - Downloading application or loader software using TML on page 806.

In boot mode …

- you can download loader software (using TML).
- you cannot download application software.
- you cannot establish a TMA session. You can only use TML to download loader software.

What is loader software?

The loader software takes care of the second phase in the start-up sequence of the Telindus 1431 SHDSL CPE. It is located on the middle software level. If the Telindus 1431 SHDSL CPE loads its boot and loader software, then we say that the Telindus 1431 SHDSL CPE runs in *loader mode*.

The Telindus 1431 SHDSL CPE …

- runs in loader mode if no application software is present.
- can be forced to loader mode by using a DIP switch. This may be necessary in case a software download failed or a flash memory error occurred making the Telindus 1431 SHDSL CPE inaccessible or even inoperative. Refer to 20.6 - Downloading application or loader software in loader mode on page 808.

In loader mode …

- you can download loader software provided you use the -b option of the TML command, temporarily forcing the Telindus 1431 SHDSL CPE to run in boot mode. Refer to 20.4 - Downloading application or loader software using TML on page 806.
- you can download application software (using TML).
- you cannot establish a TMA session. You can only use TML to download loader and application software.

What is application software

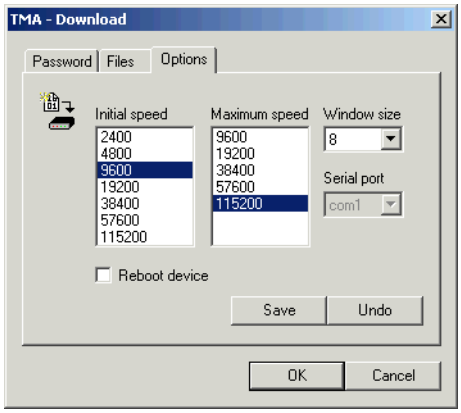
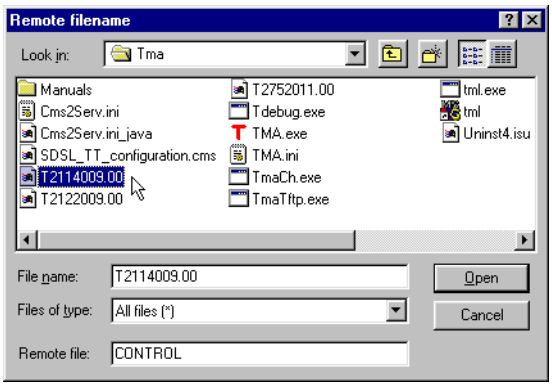
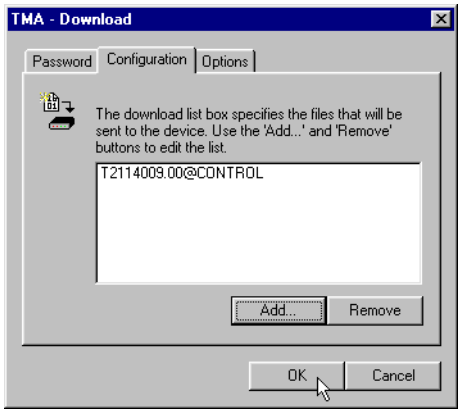
The application software, also called control software or firmware, completely controls the Telindus 1431 SHDSL CPE. It is located on the highest software level. If the Telindus 1431 SHDSL CPE loads its boot, loader and application software, then we say that the Telindus 1431 SHDSL CPE runs in *application mode*.

In application mode …

- you can download loader software provided you use the -b option of the TML command, temporarily forcing the Telindus 1431 SHDSL CPE to run in boot mode (refer to 20.4 - Downloading application or loader software using TML on page 806).
- you can download application software (using TMA, TFTP or TML).
- you can establish a TMA session.

20.2 Downloading application software using TMA

To download application software to the Telindus 1431 SHDSL CPE using TMA, proceed as follows:

Step	Action
1	Establish a link between TMA and the Telindus 1431 SHDSL CPE either over a serial or an IP connection. Refer to 4 - Maintaining the Telindus 1431 SHDSL CPE on page 35.
2	In the TMA window select *Tools* → *Download…*
3	In case you made … • an IP connection, skip this step. • a serial connection, select the *Options* tab in the *TMA - Download* window. Then set the following: - Set the initial transfer speed to 9600 bps. - Select a maximum transfer speed. If you select e.g. 57600 bps, then the actual transfer speed will be negotiated between 9600 bps and 57600 bps. 
4	In the *TMA - Download* window, select the *Configuration* tab and click on *Add…*
5	In the *Remote filename* window, do the following: 1. Select the file you want to download (e.g. T1234001.00). 2. Type `CONTROL` in the *Remote file* field. 3. Click on *Open*. 
6	If you are currently connected to the Telindus 1431 SHDSL CPE without write access, then you can enter a password in the *Password* tab which gives you write access. Else leave the *Password* tab blank.
7	When the *TMA - Download* window reappears, click on *OK*. ⇒A window opens and shows the download progress. 

20.3 Downloading application software using TFTP

When downloading with TMA over an IP connection, you actually evoke TFTP (Trivial File Transfer Protocol) through TMA. You can also use TFTP without opening TMA.

To download application software to the Telindus 1431 SHDSL CPE using TFTP, proceed as follows:

Step	Action
1	Start a TFTP session on the Telindus 1431 SHDSL CPE. For example by typing `tftp 10.0.11.1` at the command prompt of your computer, where 10.0.11.1 is the LAN IP address of the Telindus 1431 SHDSL CPE. If a write access password is configured on the Telindus 1431 SHDSL CPE, you can either enter it now or when you actually download the application software (see step 3).
2	Set the following TFTP parameters: • Set the retransmission time-out to at least 20 seconds. The syntax to do this is typically `rexmt 20`. • Set the total TFTP time-out sufficiently large (e.g. 40 seconds). The syntax to do this is typically `timeout 40`. • Set the transfer mode to binary (octet) format. The syntax to do this is typically `binary` or `octet`.
3	Type the following command: `tftp> put Txxxxxxx.00 CONTROL?my_pwd` Where … • `put` is the TFTP command to send a file. • `Txxxxxxx.00` is the application software file (e.g. T1234001.00). • `CONTROL` (in capitals!) specifies that the file being downloaded is an application software file. • `?my_pwd` is the write access password as configured in the Telindus 1431 SHDSL CPE. If no password has been configured or if you already entered one when starting the TFTP session (see step 1), you may omit the ? and the password.
4	When the file transfer is finished, close the TFTP session.

20.4 Downloading application or loader software using TML

When downloading with TMA over a serial connection, you actually evoke TML (Telindus Memory Loader) through TMA. You can also use TML without opening TMA.

To download application or loader software to the Telindus 1431 SHDSL CPE using TML, proceed as follows:

Step	Action
1	Connect a serial port of your computer (e.g. COM1) through a straight DB9 male - female cable with the control connector of the Telindus 1431 SHDSL CPE.
2	Open a DOS window on your computer.
3	Go to the directory where the TML executable is located. Typically this is *C:\Program Files\TMA*.
4	Place the software file you want to download in this directory.
5	Type the following command to download … • application software: `tml -c1 -v -fTxxxxxxx.00@CONTROL?my_pwd` • loader software: `tml -c1 -v -b -fTxxxxxxx.00@CONTROL?my_pwd` where … • `tml` is the executable (Telindus Memory Loader) to download files to the Telindus devices through their control port. • `-c1` specifies the COM port of the computer connected to the Telindus 1431 SHDSL CPE (in this example COM1). • `-v` returns graphical information on the download status. • `-b` puts the Telindus 1431 SHDSL CPE in boot mode. This is only necessary when you want to download loader software. • `-fTxxxxxxx.00` is the software file you want to download (e.g. T1234001.00). • `CONTROL` (in capitals!) specifies that the file being downloaded is an application or loader software file. • `?my_pwd` is the write access password as configured in the Telindus 1431 SHDSL CPE. If no password has been configured, you may omit the ? and the password. To see a list of all the possible TML options: type `TML` in your DOS windows and press the ENTER key.
6	If you press the ENTER key, the software download begins. If you used the *-v* option together with the TML command, a graphical bar shows the download progress.

20.5 Downloading application software using FTP

To download application software to the Telindus 1431 SHDSL CPE using FTP, proceed as follows:

Step	Action
1	Start an FTP session on the Telindus 1431 SHDSL CPE. For example by typing `ftp 10.0.11.1` at the command prompt of your computer, where 10.0.11.1 is the LAN IP address of the Telindus 1431 SHDSL CPE. If a write access password is configured on the Telindus 1431 SHDSL CPE, you can either enter it now or when you actually download the application software (see step 3).
2	Make sure the transfer mode is set to binary (octet) format. The syntax to do this is typically `binary`.
3	Type the following command: `ftp> put Txxxxxxx.00 CONTROL?my_pwd` Where … • `put` is the FTP command to send a file. • `Txxxxxxx.00` is the application software file (e.g. T1234001.00). • `CONTROL` (in capitals!) specifies that the file being downloaded is an application software file. • `?my_pwd` is the write access password as configured in the Telindus 1431 SHDSL CPE. If no password has been configured or if you already entered one when starting the FTP session (see step 1), you may omit the ? and the password.
4	When the file transfer is finished, close the FTP session.

20.6 Downloading application or loader software in loader mode

When a software download failed or when a flash memory error occurs, it may be possible that the Telindus 1431 SHDSL CPE becomes inaccessible or even inoperative. In that case, new software can still be downloaded by forcing the Telindus 1431 SHDSL CPE in loader mode. Do this by means of the *Loader mode* DIP switch. Refer to 3.2 - DIP switches of the Telindus 1431 SHDSL CPE on page 31.

To download loader or application software to a Telindus 1431 SHDSL CPE in loader mode, proceed as follows:

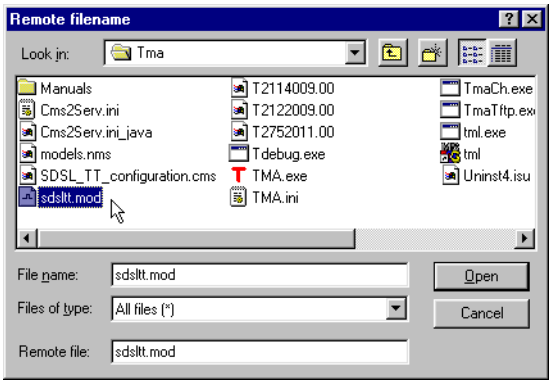
Step	Action
1	Disconnect the power supply and open the housing as described in 3.4 - Opening and closing the housing on page 33.
2	Set the *Loader mode* DIP switch to *off*. Refer to 3.1 - The Telindus 1431 SHDSL CPE motherboard on page 30 to locate this DIP switch.
3	Replace the cover without fastening the screws and reconnect the power supply. ⇒The Telindus 1431 SHDSL CPE reboots in loader mode.
4	Now proceed as explained in the previous section, 20.4 - Downloading application or loader software using TML on page 806.
5	When the software download is finished, again disconnect the power supply and open the housing.
6	Reset the *Loader mode* DIP switch to *on*.
7	Properly replace the cover as described in 3.4 - Opening and closing the housing on page 33 and reconnect the power supply.

20.7 Downloading files to the file system

You might want to download other files than the firmware files only. In fact, any file can be downloaded to the file system of the Telindus 1431 SHDSL CPE. You can do this using the same tools you use to download application software. These tools are:

- TMA (refer to 20.2 - Downloading application software using TMA on page 804).
- TFTP (refer to 20.3 - Downloading application software using TFTP on page 805).
- TML (refer to 20.4 - Downloading application or loader software using TML on page 806).
- FTP (refer to 20.5 - Downloading application software using FTP on page 807).

The major difference is that instead of specifying `CONTROL` as target filename for the application software, you now can specify any filename as target filename.

Tool	Example
TMA	In the *Remote filename* window, do the following: 1. Select the file you want to download (e.g. *sdsltt.mod*). 2. Type the target filename in the *Remote file* field (e.g. *sdsltt.mod*). 3. Click on *Open*. 
(T)FTP and TML	• `tftp> put filename1.ext filename2.ext?my_pwd` • `ftp> put filename1.ext filename2.ext?my_pwd` • `tml -c1 -v -ffilename1.ext@filename2.ext?my_pwd` Where … • `filename1.ext` is the source filename. This is a file on your computer. • `filename2.ext` is the target filename. This is the filename the source file will get when it is placed on the file system. Source and target filename may be the same, but if wanted, you may specify a different target filename. Example: • `tftp> put models.nms models.nms?pwd123` • `tml -c1 -v -fmodels.nms@models.nms?pwd123`

21 Technical specifications

This chapter gives the technical specifications of the Telindus 1431 SHDSL CPE. The following gives an overview of this chapter:

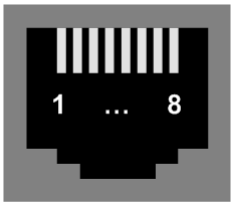
- 21.1 - SHDSL line specifications on page 812
- 21.2 - G703 interface specifications on page 814
- 21.3 - Serial interface specifications on page 815
- 21.4 - LAN interface specifications on page 816
- 21.5 - Control connector specifications on page 817
- 21.6 - IP address assignment and auto-provisioning on page 818
- 21.7 - FRF specifications on page 818
- 21.8 - CES specifications on page 818
- 21.9 - ATM encapsulation specifications on page 819
- 21.10 - Frame Relay encapsulation specifications on page 820
- 21.11 - PPP encapsulation specifications on page 820
- 21.12 - Other WAN encapsulation specifications on page 820
- 21.13 - IP routing specifications on page 821
- 21.14 - Bridging specifications on page 823
- 21.15 - Network address translation specifications on page 824
- 21.16 - Tunnelling and VPN specifications on page 825
- 21.17 - Priority and traffic policy specifications on page 826
- 21.18 - Routing and bridging performance specifications on page 828
- 21.19 - Access security specifications on page 829
- 21.20 - Maintenance and management specifications on page 829
- 21.21 - Memory specifications on page 830
- 21.22 - Power requirements on page 830
- 21.23 - Dimensions on page 830
- 21.24 - Safety compliance on page 831
- 21.25 - Over-voltage and over-current protection compliance on page 831
- 21.26 - EMC compliance on page 831
- 21.27 - Environmental compliance on page 831

21.1 SHDSL line specifications

- Single pair or dual pair line access
- Connector: RJ45
- Impedance: 135 ohm
- Cable to be used: 2*2*CAT5E twisted pair
- Coding: TC PAM, compliant to ITU-T G.991.2 (G.SHDSL)
- Line speeds:
  - Single pair: N x 64 kbps (N = 1 … 36)
  - Two pair: N x 128 kbps (N = 1 … 36)
- Handshaking: compliant G.994.1 (automatic speed negotiation) or fixed speed
- Performance monitoring: compliant G.826 (errored seconds, severely errored seconds, unavailability seconds)
- Encapsulation: ATM

The line connector lay-out

The following table shows the connector layout of the RJ45 line connector:

Pin	Signal	Figure
1	not used	
2	cable shield (optional)	
3	line 2[1]	
4	line 1	
5	line 1	
6	line 2[1]	
7	cable shield (optional)	
8	not used	

1. For a Telindus 1431 SHDSL CPE 2 pair version only.

Maximum covered distance

The following table gives the maximum covered distance over a noise-free line:

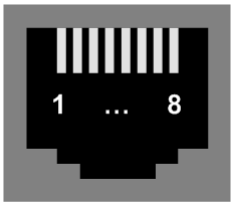
		Covered distance (km)					
Line speed (kbps)		**Wire diameter (mm)**					
1 Pair	**2 Pair**	**0.4**	**0.5**	**0.6**	**0.8**	**1.0**	**1.2**
64	128	11,0	15,1	21,5	27,2	38,2	42,4
128	256	8,0	11,0	15,6	19,8	27,8	30,8
256	512	8,2	11,3	16,0	20,3	28,5	31,6
512	1024	7,2	9,9	14,0	17,8	25,0	27,7
1024	2048	5,5	7,6	10,7	13,6	19,1	21,2
1536	3072	4,0	5,5	7,8	9,9	13,9	15,4
2048	4096	4,2	5,8	8,2	10,4	14,6	16,2
2304	4608	4,0	5,5	7,8	9,9	13,9	15,4

- These values are valid for all hardware and firmware revisions. Also note that these values are only valid when using the correct, properly twisted cable.
- A Signal to Noise ratio of 23dB matches a Noise Margin of 0dB. A Noise Margin of minimum 2dB is considered a minimum for an Error Ratio that matches at least 10E-7 (= a Signal to Noise ratio of 25dB). In performance tests with noise, usually a noise margin of 6dB is taken (= a Signal to Noise ratio of 29dB). Tests show that a Signal to Noise ratio of 27dB gives no errors and that at a Signal to Noise ratio of 25dB errors are rare.

21.2 G703 interface specifications

- Type: modular G.703 DCE interface
- Connector: RJ45
- Impedance: 120 ohm balanced
- Physical and electrical compliance: ITU-T G.703
- Cable to be used: 4*2*CAT5E shielded twisted pair
- Coding: AMI or HDB3 (configurable)
- Speed: 2 Mbps
- Clocking: external, internal, slave on network
- Framing: framed or unframed (configurable), framing compliant to ITU-T G.704
- Time slots: N x 64 kbps (N = 1 … 32)
- Unframed mode: support for Frame Relay and CES
- Fractional E1 mode: support for Frame Relay and CES
- Channelised E1 mode: support for CES
- CRC4 insertion: enabled, disabled or automatic detection (configurable), frame alignment and cyclic redundancy check compliant to ITU-T G.706
- Defect detection: compliant to ITU-T G.775
- Performance monitoring: compliant to ITU-T G.821 and G.826
- Jitter and wander: compliant to G.823

The following table shows the connector layout of the RJ45 G703 interface connector:

Pin	Signal	DCE	Figure
1	transmit A (+)	output	
2	transmit B (-)	output	
3	shielding ground	-	
4	receive A (+)	input	
5	receive B (-)	input	
6	shielding ground	-	
7	not connected	-	
8	not connected	-	

21.3 Serial interface specifications

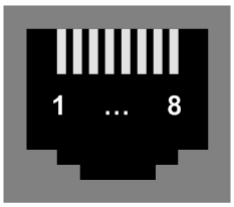
- Type: modular serial DCE interface (RS-530, V.35, V.36 or X.21)
- Speed: N x 64 kbps up to 2048 kbps (1 pair) or 4096 kbps (2 pair) in case of Frame Relay and CES
- Clocking: internal, slave on network / preferred, alternative
- Encapsulation: Frame Relay or CES

Refer to the manual of the serial interface for more specific information (e.g. connector layout etc.).

21.4 LAN interface specifications

- Connector: RJ45 (EIA/TIA 568B)
- Cable to be used: 4*2*CAT5E unshielded twisted pair
- Applicable standards: IEEE 802.3 (10Mbps Ethernet), IEEE 802.3u (100Mbps Ethernet)
- Speed: 10 / 100 Mbps auto-sense
- VLAN support (up to 12 VLANs)

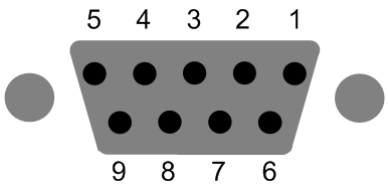
The following table shows the connector layout of the RJ45 Ethernet LAN interface connector:

Pin	Signal	I/O	Figure
1	transmit (+)	output	
2	transmit (-)	output	
3	receive (+)	input	
4	not used	-	
5	not used	-	
6	receive (-)	input	
7	not used	-	
8	not used	-	

21.5 Control connector specifications

- Connector: female DB9 labelled CTRL
- Applicable standards: ITU-T V.24, V.28, EIA/TIA 574
- Data:
  - asynchronous
  - 9600 bps
  - 8 data bits
  - no parity
  - 1 stop bit
  - no flow control

The control connector has the following pin layout:

Pin	Signal		DCE	Figure
1	not used	-	-	
2	Receive Data	RxD	output	
3	Transmit Data	TxD	input	
4	not used	-	-	
5	GND	GND	-	
6	not used	-	-	
7	not used	-	-	
8	not used	-	-	
9	not used	-	-	

21.6 IP address assignment and auto-provisioning

- BOOTP/DHCP server (RFC 2131, RFC 2132) with static or dynamic address assignment
- DHCP server major features:
  - IP address ranges are configurable per interface
  - If no gateway is configured in the DHCP server, the router gives its own address
  - The DHCP server collects the DNS names of all DHCP clients and acts as a local DNS server for these names
- DHCP relay agent (RFC 2131, RFC 2132)
- DNS proxy
- Static IP address assignment
- Possible assignment of secondary IP address on the LAN interface
- Numbered or unnumbered mode on WAN interfaces
- Automatic IP address assignment through:
  - BootP client (RFC 951)
  - DHCP client (RFC 2131, RFC 2132)
  - IPCP
- Automatic IP gateway assignment through Inverse ARP (RFC 2390, in Frame-Relay and ATM)
- Automatic default route assignment on remotely learned IP address in PPP
- Automatic configuration file upload through DHCP client
- DHCP client requests are transmitted if an interface is in routing mode and has no IP address yet
- DHCP client requests can be blocked from being transmitted on the LAN interface and bridge groups

21.7 FRF specifications

- Frame Relay / ATM PVC Network Interworking Implementation Agreement (FRF.5)
- Frame Relay / ATM PVC Service Interworking Implementation Agreement (FRF.8.1)

21.8 CES specifications

- ATM Forum af-vtoa-0078.000 Circuit Emulation Service (CES) version 2.0
- Clocking synchronised to network clock

21.9 ATM encapsulation specifications

- ATM cell format ITU-T I.311, I.321, I.361, I.432
- ATM forum UNI 3.1/4.0 PVCs
- ATM forum ILMI 3.1/4.0
- OAM F4/F5 LB and CC support (ITU-T I.610)
- Inverse ARP for automatic gateway configuration
- ATM Forum Traffic Management 4.0 service type UBR, VBR and CBR
- PCR, SCR and MBS configurable per ATM PVC
- Support of 12 routing/bridging ATM PVCs (IP AAL5) and …
  - 18 FRF PVCs (in case the user interface runs Frame Relay).
  - 5 CES PVCs + 1 low speed PVC (in case the user interface runs CES).
  - 18 switching ATM PVCs (in case the user interface runs ATM).
- Support of a low speed management PVC in case of CES (PCR=2120 bps (5 ATM cells per second), CDV = 1 ms)
- ATM VPI range 0 - 255
- ATM VCI range 32 - 10000
- Supported higher layer protocols:
  - Classical IP (RFC 1577)
  - Ethernet (RFC 2684)
  - PPPoA (RFC 2364)
  - PPPoE (RFC 2516)
- Multi-protocol encapsulation:
  - LLC
  - VC

21.10 Frame Relay encapsulation specifications

- Encapsulation compliant with RFC 1490, RFC 2427
- LMI (revision 1 LMI, ANSI T1.617 D, ITU-T Q.933 Annex A and FRF 1&2)
- CIR configurable per DLCI
- EIR configurable per DLCI
- Inverse ARP for automatic gateway configuration
- Support of up to 12 Frame Relay PVCs (DLCIs)
- Frame Relay DLCI range 16 - 1022
- Multi-link Frame Relay (FRF.16)
- Frame Relay fragmentation (FRF.12)

21.11 PPP encapsulation specifications

- Encapsulation compliant with RFC 1661, RFC 1662
- LCP
- IPCP (RFC 1332)
- BCP (RFC 2878)
- CCP (RFC 1962) with Predictor compression algorithm (RFC 1978)
- PAP authentication (RFC 1334), unidirectional or bi-directional authentication
- CHAP authentication with MD5 hashing (RFC 1994), unidirectional or bi-directional authentication
- MS-CHAP1 (RFC 2433) and MS-CHAP2 (RFC 2759) CHAP authentication protocol extension
- MLPPP (RFC 1990)
- MLPPP bundle name exchange
- PPP fragmentation (RFC 1990), enabled to fixed size of 200 bytes or disabled
- MCPPP (RFC 2686)

21.12 Other WAN encapsulation specifications

- HDLC encapsulation in bridging mode (not interoperable with Cisco HDLC encapsulation)
- Error test encapsulation for end-to-end error tests over TDM networks between Telindus devices

21.13 IP routing specifications

The Telindus 1431 SHDSL CPE complies to the router requirements as stated in RFC 1812 and supports the routing of standard IP packets (RFC 791) between the different interfaces of the Telindus 1431 SHDSL CPE according to the routing protocols listed below.

Static routing

- Routing is based on destination IP address
- Routing is based on static routing entries in the routing table
- Alternate routing is possible through the use of different preferences for different routes to the same destination

Policy based routing

- Routing is based on additional higher layer information
- Traffic is routed to a certain interface or gateway based on one or more of the following parameters:
  - Source IP address range
  - Destination IP address range
  - Type Of Service (TOS) value range (8 bits in the IP header, also called DSCP bits)
  - IP protocol (examples are any (0), ICMP (1), IGMP (2), TCP (6), UDP (17))
  - Source port range for UDP / TCP packets
  - Destination port range for UDP / TCP packets

RIP

- RIP1 compliant with RFC 1058
- RIP2 compliant with RFC 2453
- Split horizon and selective router updates per interface
- Broadcasting of selective RIP updates limited to information on specific network subnets
- RIP2 authentication with MD5 hashing or clear text

OSPF

- Compliant with RFC 2328 (OSPF version 2)
- Import of statically configured routes
- Route summarisation and route suppression through range definitions on areas
- Encryption through simple password or MD5 encryption chains

ICMP

Support of ICMP messages (RFC 792):

- TTL exceeded
- Destination unreachable

Multicasting and broadcasting

The Telindus 1431 SHDSL CPE supports the handling of broadcasts and multicasts and includes the following related functionalities:

- IGMPv2 (Internet Group Management protocol, RFC 2236), as the standard for IP multicasting
- IGMP proxy function
- Forwarding of directed broadcasts can be enabled or disabled per interface
- Helper address can be configured for broadcasts

Filtering

- Filtering of outgoing traffic on all interfaces based on extended access lists
- Filtering of incoming traffic on all interfaces based on extended access lists
- Filtering of incoming traffic on the IP protocol stack based on an extended access list
- IP extended access lists filter on the following parameters:
  - Source IP address range
  - Destination IP address range
  - Type Of Service (TOS) value range (8 bits in the IP header, also called DSCP bits)
  - IP protocol (examples are any (0), ICMP (1), IGMP (2), TCP (6), UDP (17))
  - Source port range for UDP / TCP packets
  - Destination port range for UDP / TCP packets

IP MTU

- The IP MTU can be configured on the WAN and LAN interfaces (between 500 and 1650 bytes)

VRRP

- Support of VRRP (RFC 2338)

21.14 Bridging specifications

- Bridging can be enabled or disabled per interface
- Bridging can be combined with routing on the same interface

Bridging protocols

- Self-learning bridging can be enabled or disabled
- Cache of at least 10,000 MAC addresses
- Support of Spanning Tree protocol (IEEE 802.1D)

Bridge groups

- Multiple bridge groups possible
- IP address assignment per bridge group (for management purposes)
- Secondary IP addresses can be configured per bridge group
- MAC address configurable per bridge group
- Routing between different bridge groups possible

VLANs

- Support of VLANs (IEEE 802.1Q)
- Up to 255 VLANs per LAN interface
- Support of VLAN priority tagging (IEEE 802.1P)
- Multiple VLANs within a bridge group towards the IP router possible
- IP TOS to 802.1P COS mapping and COS to TOS mapping are available on the LAN interface to maintain priority information when changing from IP to VLAN or vice versa
- IP TOS to 802.1P COS mapping and COS to TOS mapping are available on the data sent between a bridge group and the IP router to maintain priority information when changing from IP to VLAN or vice versa
- MIB2 performance counters are available per VLAN

VLAN switching

- Bridge group can be configured as VLAN switch
- Q in Q as defined in IEEE 802.1ad possible
- No practical limit on the number of VLANs in VLAN switching mode
- VLAN switching mode can be combined with bridging mode for packets on the same interface

Filtering

- Filtering of outgoing bridged traffic on all interfaces based on access lists
- Bridge access lists filter on source MAC address
- Limit broadcasts in a bridge group per interface
- Proxy ARP cache

21.15 Network address translation specifications

- Compliant with RFC 3022
- NAT mode for one-to-one private to public IP address translation
- PAT mode for many-to-one private to public IP address translation
- NAT/PAT configurable on any interface (the interface with the public address(es))
- Up to 5 NAT/PAT interfaces
- Static and dynamic assignment of NAT official addresses
- List of UDP/TCP port numbers that should not be translated
- List of incoming UDP/TCP port numbers destined for a server
- Easy NAT: CPE learns official IP address via PPP
- Application Layer Gateway (ALG) support including:
  - General: FTP, ICMP (Echo, Echo Response, Destination Unreachable, Time Exceed & Source Quench), SQLNet
  - Microsoft Games
  - Video / Streaming applications: RTSP, QuickTime, Real Player (Real Audio / Real Video), H.323 (ASN1 PER encoding and decoding included), NetMeeting, Intel Video Phone, CuseeMe 5.0, SIP Audio
  - Communication: Internet Chat, IRC, MIRC, AOL Instant Messenger, AOL enhanced chat, ICQ2000b, Net2Phone, Microsoft Messenger
  - Security Related: PPTP, IPSec ESP (IPSec client from internal network), IKE, L2TP

21.16 Tunnelling and VPN specifications

L2TP tunnelling

- Compliant with RFC 2661
- Up to 10 L2TP tunnels
- Available on LAN and WAN interfaces
- Static and dynamic tunnels
- Tunnel authentication
- Available for IP and bridged PDUs
- One L2TP tunnel between each pair of IP addresses
- One PPP session per L2TP tunnel
- L2TP tunnels can be set up from an interface running NAT/PAT
- L2TP backup tunnels
- RIP snapshot routing on L2TP tunnels

IPSEC security

- Compliant with RFC 2401 up to RFC 2406
- L2TP transport mode (RFC 3193)
- Up to 10 IPSEC tunnels (independently of the number of L2TP tunnels)
- ESP (RFC 2406)
- DES (56 bits; RFC 2405), 3DES (3 * 56 bits; RFC 2451) and NULL (RFC 2410) encryption
- HMAC based on MD5 (RFC 2403) and SHA-1 (RFC 2404) for integrity and authentication
- Manual SAs

21.17 Priority and traffic policy specifications

This section gives the specifications of the priority and traffic policies that are available on the Telindus 1431 SHDSL CPE. The following gives an overview of this section:

- 21.17.1 - Priority policy on page 827
- 21.17.2 - IP traffic policy on page 827
- 21.17.3 - Bridge traffic policy on page 827

21.17.1 Priority policy

- 7 forwarding queues per interface:
  - 5 standard, configurable queues
  - 1 low delay queue
  - 1 system queue
- Quotum and weight configurable per standard queue
- Supported algorithms to empty the standard queues:
  - FIFO
  - Round robin
  - Absolute priority
  - Weighted fair queueing
  - Low delay weighted fair queueing
- CIR configurable per standard queue

21.17.2 IP traffic policy

Supported IP traffic policies:

Traffic shaping

- Traffic is forwarded to a certain priority queue based on the following parameters:
  - Source IP address range
  - Destination IP address range
  - Type Of Service (TOS) value range (8 bits in the IP header, also called DSCP bits)
  - IP protocol (examples are any (0), ICMP (1), IGMP (2), TCP (6), UDP (17))
  - Source port range for UDP / TCP packets
  - Destination port range for UDP / TCP packets
- TOS value can be changed during traffic shaping
- Configurable maximum queue length
- Performance information on classified traffic

TosDiffServ

- Traffic is forwarded to a certain priority queue based on DiffServ (RFCs 2474, 2475) regarding class and drop precedence

TosMapped

- Traffic is forwarded to a certain priority queue based on a user-defined range of the TOS field
- Configurable maximum queue length

21.17.3 Bridge traffic policy

- Traffic is forwarded to a certain priority queue based on the 802.1P tag of VLAN tagged Ethernet traffic

21.18 Routing and bridging performance specifications

- Routing performance: 40.000 pps[1]
- Bridging performance: 30.000 pps

1. In case you enable encryption in IPSEC, then the routing performance decreases.

21.19 Access security specifications

- Password protected
- Several access levels possible:
  - Read access
  - Write access
  - Security access
  - File system access
- Radius client (RFC 2865)
- Management access can be enabled or disabled per interface
- Overall management access can be prohibited (Telnet, HTTP, SNMP, FTP, TFP)

21.20 Maintenance and management specifications

- Local console (Command Line Interface or ATWIN) via serial control port
- TELNET (Command Line Interface or ATWIN) (RFC 854)
- HTTP web interface[1] (RFC 2616)
- Easy Configurator (customisable JAVA based web interface)
- TMA (Telindus Maintenance Application) via serial control port or IP connection (UDP port 1728)
- TMA CLI[2]
- TMA Element Management[2]
- TMA for HP OpenView[2]
- TML (Telindus Memory Loader) for configuration and software download via serial control port
- FTP configuration and software download (RFC 414)
- TFTP configuration and software download (RFC 1350)
- PING (RFC 792)
- SNMP (RFC 1157)
- SNMP MIB2 (RFC 1213), private MIB
- SNMP traps (RFC 1215)
- SYSLOG event logging (RFC 3164)
- SNTP (RFC 2030)
- IP loopback address

1. HTTP interfaces are available on both port 80 and port 8080. This allows connecting to the HTTP interfaces in case a NAT service is defined on port 80.
2. Not included.

21.21 Memory specifications

- Flash memory: 8 Mb
- RAM: 8 Mb

21.22 Power requirements

- Connector:
  - 1 external power adapter socket (9 Vdc)
  - 1 mini-combicon power socket (-48 Vdc) (also a mini-combicon power plug is delivered with the Telindus 1431 SHDSL CPE)
- Maximum wire cross-section that can be inserted in the mini-combicon power plug: 1.5 mm^2
- Power adapter to be used:
  - 9 Vdc, 1000 mA
  - or (do not use both power supplies simultaneously)
  - -48 Vdc, 130 mA
- Maximum power consumption:
  - 1Pair version without interface: 4.2 W
  - 2Pair version without interface: 5.7 W
  - with interface: + 1 W
- -48 Vdc power input range: -20 up to -72 Vdc

21.23 Dimensions

- Height: 45 mm
- Width: 220 mm
- Depth: 210 mm
- Weight: 700 g

21.24 Safety compliance

- EN60950-1
- Class 1 equipment for Table Tops with 115/230 Vac internal power supply.
- Class 3 equipment for …
  - Table Tops with 115/230 Vac external power supply adapter
  - Table Tops with -48 Vdc internal power supply
  - Card Versions.

21.25 Over-voltage and over-current protection compliance

The over-voltage and over-current protection complies with ITU-T K.44 and ETSI ETS 300 386-2 recommendations.

21.26 EMC compliance

- EN55022 B Emissions
- EN55024 Immunity
- EN61000-3-2 Harmonics
- EN61000-3-3 Voltage fluctuations and flicker
- EN61000-4-2 ESD
- EN61000-4-3 Radiated immunity
- EN61000-4-4 EFT/burst
- EN61000-4-5 Surge
- EN61000-4-6 Conducted immunity
- EN61000-4-8 Power magnetic field immunity
- EN61000-4-11 Voltage dips & drops
- ENV50204 Radiated immunity against digital radio telephone

21.27 Environmental compliance

- Storage conditions: ETSI ETS 300 019-1-1 Class 1.1. In addition, the storage temperature has to be between -25 to +70°C
- Transport conditions: ETSI ETS 300 019-1-2 Class 2.3
- Stationary use conditions: ETSI ETS 300 019-1-3 Class 3.2. In addition, a relative humidity between 0 to 95% non-condensing and an ambient operational temperature between -10 to 50°C is supported.
- Maximum altitude: 3000m
- International protection (IP) class of protection against solid and liquids: IP40

Annex

Annex A: common TCP and UDP numbers

The following table shows the port numbers for a number of common protocols using TCP and UDP as transport protocol. As far as possible, the same port numbers are used for TCP as for UDP. A complete list can be found on http://www.iana.org/assignments/port-numbers.

Port No	Protocol	UDP/TCP	Description
20	ftp-data	TCP	File Transfer (Default Data)
21	ftp	TCP	File Transfer (Control)
23	telnet	TCP	Telnet
25	smtp	TCP	Simple Mail Transfer Protocol
37	time	UDP/TCP	Time Server
42	nameserver	UDP	Host Name Server
53	domain	UDP/TCP	Domain Name Server
65	tacacs-ds	UDP/TCP	TACACS-Database Service
67	bootps	UDP	Bootstrap Protocol Server
68	bootpc	UDP	Bootstrap Protocol Client
69	tftp	UDP	Trivial File Transfer
80	www-http	TCP	World Wide Web HTTP
119	nntp	TCP	Network News Transfer Protocol
137	netbios-ns	UDP	NETBIOS Name Service
138	netbios-dgm	UDP	NETBIOS Datagram Service
139	netbios-ssn	UDP	NETBIOS Session Service
161	snmp	UDP	SNMP
162	snmptrap	UDP	SNMPTRAP
1728	telindus	UDP	Telindus Protocol used by TMA

Annex B: product information

The following table displays the product information of the Telindus 1431 SHDSL CPE:

Sales code	Product name	Description
178722	TELINDUS 1431 SHDSL CPE BU 230VAC	IP router / bridge desktop unit. 10/100Mbit/s Ethernet interface + Modular Crocus Interface (not included). Encapsulation ATM. Supports CES sync clock mode, FRF.5 & FRF.8. WAN interface: S-HDSL line interface. Includes European 230VAC power adapter
178721	TELINDUS 1431 SHDSL CPE BU NPWR	IP router / bridge desktop unit. 10/100Mbit/s Ethernet interface + Modular Crocus Interface (not included). Encapsulation ATM. Supports CES sync clock mode, FRF.5 & FRF.8. WAN interface: S-HDSL line interface. Delivered without power adapter
178717	TELINDUS 1431 SHDSL 2P CPE BU 230VAC	IP router / bridge desktop unit. 10/100Mbit/s Ethernet interface + Modular Crocus Interface (not included). Encapsulation ATM. Supports CES sync clock mode, FRF.5 & FRF.8. WAN interface: S-HDSL 2P line interface. Includes European 230VAC power adapter.
178718	TELINDUS 1431 SHDSL 2P CPE BU NPWR	IP router / bridge desktop unit. 10/100Mbit/s Ethernet interface + Modular Crocus Interface (not included). Encapsulation ATM. Supports CES sync clock mode, FRF.5 & FRF.8. WAN interface: S-HDSL 2P line interface. Delivered without power adapter.
143666	V.35 INTF.CROCUS	Plug-in modular interface V.35 transparent.
142199	V36 INTF.CROCUS	Plug-in modular interface V.36 transparent.
142200	X.21 INTF.CROCUS	Plug-in modular interface X.21 transparent.
161611	RS-530 INTF.CROCUS	Plug-in modular interface RS-530 transparent.
188245	G703 INTF NX64K CROCUS	Plug-in mod intf G.703.
175590	PWR-PLUG (EUR VERSION)230VAC >9VDC	Wallplug power module European type, 230Vac -> 9Vdc for Desktop units delivered without power adapter. (xxx NPWR).
175592	PWR-PLUG (UK VERSION) 230VAC->9VDC	Wallplug power module UK type, 230Vac -> 9Vdc for Desktop units delivered without power adapter. (xxx NPWR).
191706	PWR-PLUG +/-48/24VDC FOR 7,5/9VDC CPE DEVICES	Wallplug power module with input range: 18 to 72Vdc and output: 7,5 / 9Vdc for Desktop units delivered without power adapter. (xxx NPWR). Fully isolated input. Suitable for + & - DC voltages.

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